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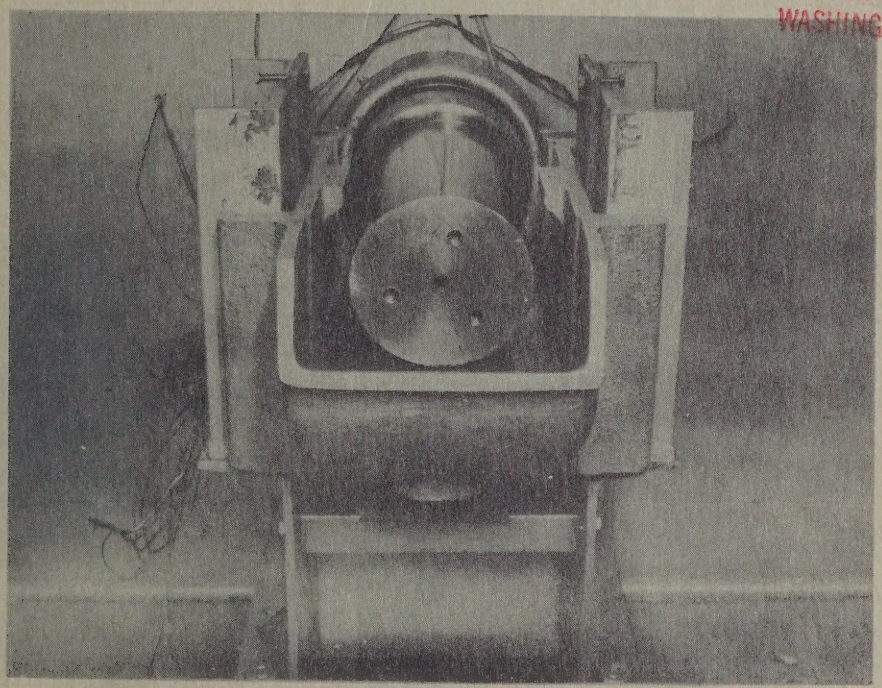

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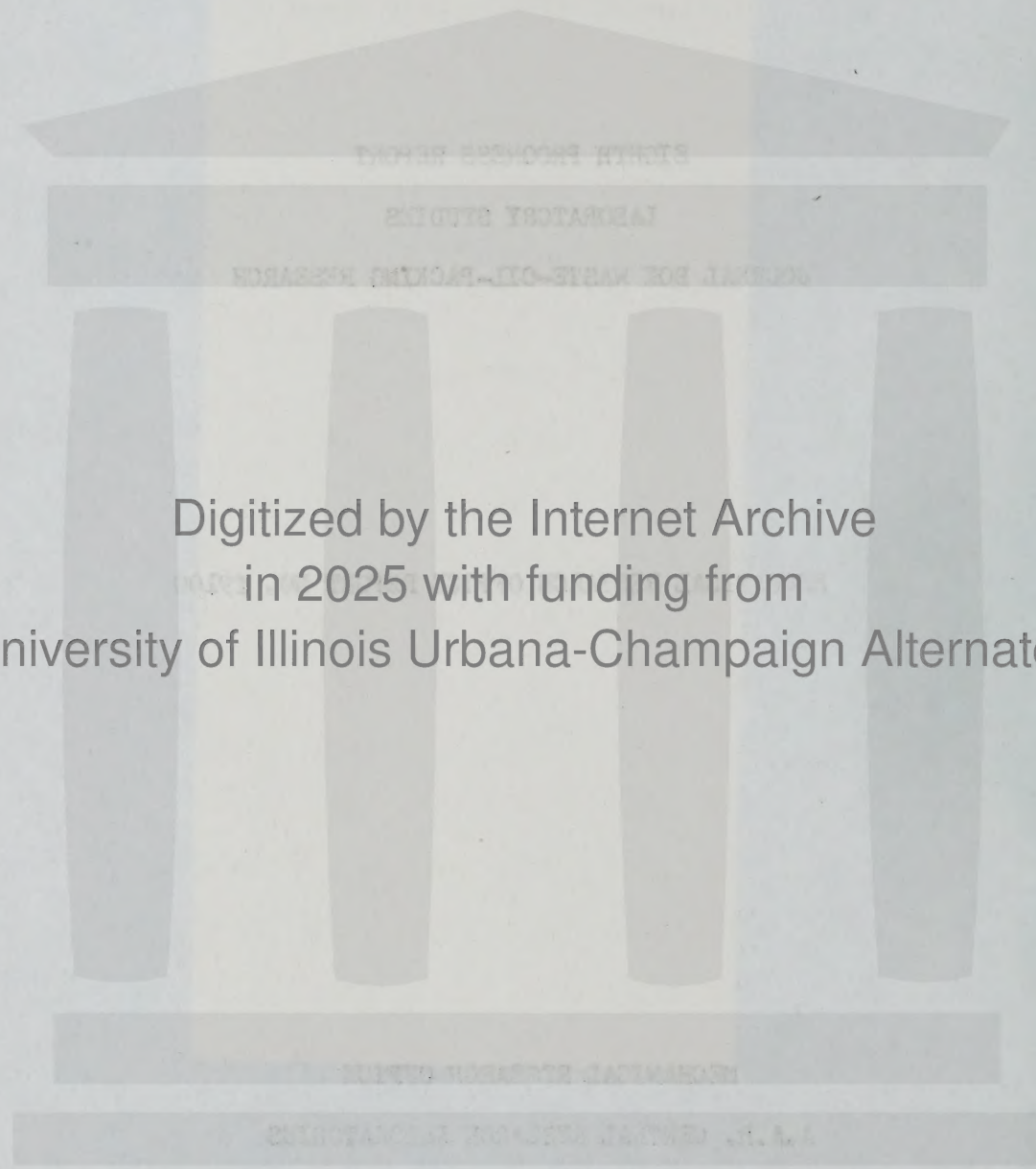

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PREFACE

This report continues the record of certain activities of the Mechanical Research Department relative to the Journal Box Waste Thread-Oil-Packing research program, with the objective of leading to better lubrication of the conventional solid type bearing journal box assembly for railway cars.

The nine parts of this report are only generally related, and are of value and interest as individual studies. The data has been prepared in this report to establish a permanent record for reference. Where conclusions or discussions are appropriate they are included in the separate parts of the report. The indication that the waste pack constitutes a major problem, as reported in the SEVENTH PROGRESS REPORT, continues.

Some of the work covered in this report was inaugurated as a result of Committee assignments. However, considerable research was done on projects whenever it seemed that an idea or suggestion made within the Mechanical Research Office personnel had the possibility of improving journal box performance and consequently, eliminating some of the hot boxes. For example, the work done in testing oils of various viscosities, as reported in Part IV, was initiated because of the logical assumption that if reducing oil viscosities from 50-55 at 210° F to 40-42 at 210° F resulted in a lower bearing operating temperature, reducing viscosity still further should cause a still lower bearing operating temperature.

The work covered by this report was conducted under the general direction of Mr. W. M. Keller, Director of Mechanical Research, and the direct supervision of Mr. W. M. English, Executive Engineer, at the A.A.R. Central Research Laboratory.

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CONCLUSIONS

1. None of the oils tested gave evidence of providing improved lubrication in road service. See Part I, page 2.

2. The use of lighter oils results in a greater loss from the car journal box due to vaporization than is encountered when heavier oils (50-55 viscosity) are used. See Part II, page 12.

3. Pressure of the waste against the journal is responsible for a significant proportion of the total heat generated, and increases as the pressure on the waste is increased against the journal. See Part III, page 28.

4. Bearing operating temperature decreases as the viscosity decreases. However, film strengths of the lower viscosity oils require further investigation. See Part IV, page 38.

5. A waste retaining rib located so that the box packing surrounds the rib reduces the tendency of waste to roll, or be displaced. See Part V, page 50.

6. The use of MS-40 extreme pressure, sulphur type additives did not show any corrosive effect on the journals, but did show a tendency to discoloration. See Part VI, page 61.

7. Cellulose blocks used as a substitute for journal box packing showed no evidence of being superior to the present waste packing, and showed some indications that failures would probably be encountered in cold weather due to lack of resiliency when the cellulose material was cooled to $0^{\circ}F$ or less. See Part VII, page 75.

8. A glass fiber material which was recommended as a satisfactory medium for journal box lubrication was found to be completely unsatisfactory. See Part VIII, page 83.

9. Threads for journal box waste which could be covered by a specification requiring certain tensile strength to improve the waste have not yet been located in commercial supply, but this problem is being studied further. See Part IX, page 89.

PART I

LABORATORY INVESTIGATION OF CAR JOURNAL OILS SUBMITTED BY SUPPLIERS AS ALL-YEAR OIL UPON INVITATION TO DO SO AT A JOINT CONFERENCE AT THE CENTRAL RESEARCH LABORATORY, JUNE 7, 1951 (MRP-18.1)

OBJECT OF TESTS

The data and results of tests herein are supplemental to Section 2, Part II of the Seventh Progress Report, designated as Report No. f5200.

A joint conference of the Joint Subcommittee on Journal Bearing Research and the suppliers of car journal oil was held at the Central Research Laboratory on June 7, 1951. At that conference, procedures, motion pictures and test results were explained and discussed, covering tests of oils previously submitted by the suppliers. When discussing some of the undesirable actions or characteristics of the oils tested, suppliers were invited to submit any additional samples which might result in improved performance over those previously submitted. Subsequently, six suppliers furnished a total of fifteen samples which are described in following data sheets. Of the 15 samples furnished, the physical characteristics were so nearly alike in several cases that only one representative sample was tested. Consequently, the 15 samples were reduced to seven representative samples, the results of which are reported herein.

PROCEDURE

Seven of the above sample oils were tested under the Hot-Stabilization (H-S) one-day schedule at the Indianapolis Lubrication Laboratory of the Railway Service and Supply Corporation during March, 1952. The test schedule followed is identical with that employed for Section 2, Part II of the Seventh Progress Report. Since the machine and schedule have been previously described in detail in former reports, the description is not repeated herein.

DISCUSSION OF RESULTS

While these tests are informative and supplemental to the previous tests at Indianapolis, they offer nothing to change former conclusions except that the procedure and data are perhaps insufficient on which to base conclusions other than comparisons.

Table A, page 4, shows the physical characteristics of the oils tested, as well as those which were received, but not tested, as determined by both the supplier and the A.A.R. analyses.

Data Sheets, pages 5 to 11, inclusive, show all of the data obtained during the tests in the full-scale testing machine at Indianapolis. A study of these figures shows that there was no significant improvement in the operating temperature of the bearing, or any other characteristics in the performance of the oil that would justify a conclusion that their use would diminish hot boxes in service if used in lieu of the present journal box oil. In view of this condition no further study was made of the remaining eight untested samples as it was not felt that the possibility of improving journal performance over the first seven samples tested could be expected from a review of the physical characteristics of the oil.

TABLE - A

PHYSICAL PROPERTIES OF OILS - PART I

OIL CONSTITUENT / SPECIFICATION ITEMS	Esso Standard Oil Co. ESSO WS-2250	Esso Standard Oil Co. ESSO WS-2252	Humble Oil & Refining Co. HUMBLE SX 7892	Humble Oil & Refining Co. HUMBLE SX 7894	Richfield Oil Corporation RICHFIELD WR 5830-E	Sun Oil Company SUN OIL "C"	Sun Oil Company SUN OIL "D"	Cities Service Oil Co. CITIES SERVICE 411	Esso Standard Oil Co. ESSO WS-2251	Esso Standard Oil Co. ESSO WS-2253	Esso Standard Oil Co. ESSO WS-2254	Humble Oil & Refining Co. HUMBLE SX 7893	Mohawk Refining Corp. MOHAWK X51MA	Sun Oil Company SUN OIL "A"	Sun Oil Company SUN OIL "B"
NOTES	a	a	a	a	a	a	a	b	b	b	b	b	b	b	b
DATA SHEET NOS.	H-S-22	H-S-23	H-S-26	H-S-27	H-S-28	H-S-24	H-S-25								
VISCOSITY, S.U.S. at 100°F — Supplier's Analysis	164	175	139.2	137.2	268				165	163	174	139.3	122		
at 100°F — RS&SC Check Analysis	168	177	140	137	270	320	186								
at 210°F — Supplier's Analysis	43.3	44.7	42.4	42.3	49.5	52.8	45.3	40.5	43.5	43.3	44.6	42.5	41.1	46.9	46.9
at 210°F — RS&SC Check Analysis	44.4	45.3	43.3	42.5	50.0	53.6	46.3								
VISCOSITY INDEX — Supplier's Analysis	81	97	99	99	91.5	93	100	99	84	81	96	99	96	91	92
VISCOSITY INDEX — RS&SC Check Analysis	100	104	117	104	91	98	109								
POUR POINT — Supplier's Analysis	-25	-25	-35+	-35+	-30	-30	-35	-35	-25	-25	-25	-35+	-35	-30	-30
POUR POINT — RS&SC Check Analysis	-15	-15	below -20	below -20	below -20	-20	below -20								
FLASH POINT — Supplier's Analysis	390	370	360	360	355	440	300	390	385	380	375	360	290	415	420
FLASH POINT — RS&SC Check Analysis	380	370	355	340	340	415	325								
MOISTURE	-	-	-	-	-	none	none	none	-	-	-	-	nil	none	none
TARRY MATTER, PERCENT	.03	.08	-	-	.03	none	none	none	.08	.06	.08	-	nil	none	none
INSOLUBLE IMPURITIES, PERCENT	.02	.003	-	-	.01	none	none	none	.02	.007	.01	-	nil	none	none
ACIDITY	none	none	-	-	-	.01	.01	neut.	none	none	none	-	neut.	.01	.66
VISCOSITY AT -15°F (extrapolated)	33,000	35,000	13,000	11,800				4500	34,000	33,000	34,000	11,600	5200		
GRAVITY°, API at 60°F, RS&SC Anal.	27.6	28.0	29.8	29.4	25.5	30.1	23.3		27.3	26.7	27.1	29.3			

NOTES: a. Oils tested and described in this report.
b. Oils not tested.

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 170 °F. Time Standing at 130 °F to Start of Test: 17 Hrs.

OIL: Supplied by ESSO STANDARD OIL COMPANY Designation: ESSO WS-2250

DIRECTION OF ROTATION	LINE NO. REFERENCE	LOCATION IN SCHEDULE / DATA	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	117	118	120	122	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	154	158	121	130	28	0.98 *
	3	After 15 Mins. at 100 MPH	33.3	198	199	122	133	66	0.61
	4	After 30 Mins. at 100 MPH	58.3	225	220	124	130	90	0.53
	5	After 45 Mins. at 100 MPH	83.3	238	235	129	127	108	0.49
	6	After FIRST HOUR of 100 MPH Run	108.3	243	245	136	131	114	0.43
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	256	251	143	132	119	0.43
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	261	256	151	133	123	0.43
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	263	259	159	130	129	0.43
	10	After SECOND HOUR of 100 MPH Run	208.3	266	261	164	128	133	0.42
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	267	263	173	130	133	0.41
	12	After THIRD HOUR of 100 MPH Run	308.3	268	265	180	130	135	0.41
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	268	266	183	130	136	0.39
	14	After FOURTH HOUR of 100 MPH Run	408.3	269	267	186	131	136	0.40
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	270	267	187	129	138	0.39
	16	After FIFTH HOUR of 100 MPH Run	508.3	270	267	190	130	137	0.37
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	268	266	194	130	136	0.36
	18	After SIXTH HOUR of 100 MPH Run	608.3	268	266	198	130	136	0.36
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	268	266	200	130	136	0.36

Amount of Oil Thrown from Box After First Five Hours 7 oz. Avg Torque (Avg, Lines 16 and 19) 0.365

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis. Secs. at: 100°F 168 ; at 210°F 44.4 ; at 0°F 9500 ; at stabilized temp. of 270 °F: 36.8.

Viscosity Index: 100 Pour Point -15 °F Flash Point 380 °F.

STOCKS USED: Gravity°, API @ 60°F 27.6

Made up in August, 1951 at Bayonne Refinery, Bayonne, New Jersey, from:
- Paraffinic (Mid-Continent Source)
- Pour Point Depressant: Paraflow (no amount given)

REMARKS: *Maximum torque developed during acceleration to 100 MPH speed was 1.03 lbs/ton.

SERIES 104 TEST NUMBER 22 DATE OF TEST RUN 3-12-52 DATA SHEET NO. H-S -22

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 247 °F. Time Standing at 130 °F to Start of Test: 17 Hrs.

OIL: Supplied by ESSO STANDARD OIL COMPANY Designation: ESSO WS-2252

DIRECTION OF ROTATION	LINE NO. REFERENCE	DATA / LOCATION IN SCHEDULE	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	132	133	138	131	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	161	164	137	131	33	0.81
	3	After 15 Mins. at 100 MPH	33.3	212	209	136	131	78	0.59
	4	After 30 Mins. at 100 MPH	58.3	234	230	138	130	100	0.51
	5	After 45 Mins. at 100 MPH	83.3	247	243	143	130	113	0.48
	6	After FIRST HOUR of 100 MPH Run	108.3	256	251	150	130	121	0.45
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	261	257	159	130	127	0.45
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	263	259	167	130	129	0.45
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	266	262	174	130	132	0.45
	10	After SECOND HOUR of 100 MPH Run	208.3	267	263	180	130	133	0.44
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	269	266	187	130	136	0.40
	12	After THIRD HOUR of 100 MPH Run	308.3	271	267	190	130	137	0.40
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	273	269	192	130	139	0.40
	14	After FOURTH HOUR of 100 MPH Run	408.3	275	270	192	130	140	0.40
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	276	272	193	130	142	0.40
	16	After FIFTH HOUR of 100 MPH Run	508.3	277	273	193	130	143	0.40
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	271	268	192	130	138	0.29
	18	After SIXTH HOUR of 100 MPH Run	608.3	270	267	187	130	137	0.31
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	269	267	184	130	137	0.31

Amount of Oil Thrown from Box After First Five Hours 9.5 oz. Avg Torque (Avg, Lines 16 and 19) 0.355

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis. Secs. at: 100°F 177 ; at 210°F 45.3 ; at 0°F 10,000 ; at stabilized temp. of 277 °F: 36.7.

Viscosity Index: 104 — Pour Point -15 °F — Flash Point 370 °F.

STOCKS USED: — Gravity°, API @ 60°F 28.0

Made up in August, 1951 at Bayonne Refinery, Bayonne, New Jersey, from:
- Paraffinic (Mid-Continent Source)
- Pour Point Depressant: Paraflow (no amount given)

REMARKS: * Maximum torque developed during acceleration to 100 MPH speed was 0.84 LBS/TON

SERIES 104 — TEST NUMBER 23 — DATE OF TEST RUN 3-13-52 — DATA SHEET NO. H-S - 23

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 233 °F. Time Standing at 130 °F to Start of Test: 17 Hrs.

OIL: Supplied by SUN OIL COMPANY Designation: SUN OIL "C"

DIRECTION OF ROTATION	LINE NO. REFERENCE	LOCATION IN SCHEDULE / DATA	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	133	134	135	135	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	167	173	135	128	45	0.96 *
	3	After 15 Mins. at 100 MPH	33.3	220	220	136	132	88	0.56
	4	After 30 Mins. at 100 MPH	58.3	244	241	143	130	111	0.44
	5	After 45 Mins. at 100 MPH	83.3	257	257	158	130	127	0.40
	6	After FIRST HOUR of 100 MPH Run	108.3	265	260	167	130	130	0.39
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	268	263	181	130	133	0.38
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	270	270	183	130	140	0.38
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	272	268	190	130	138	0.37
	10	After SECOND HOUR of 100 MPH Run	208.3	273	269	193	130	139	0.37
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	275	271	202	130	141	0.37
	12	After THIRD HOUR of 100 MPH Run	308.3	277	273	205	130	143	0.36
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	278	274	207	131	143	0.36
	14	After FOURTH HOUR of 100 MPH Run	408.3	278	275	209	131	144	0.36
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	279	276	210	131	145	0.33
	16	After FIFTH HOUR of 100 MPH Run	508.3	280	276	212	129	147	0.31
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	280	275	205	130	145	0.41
	18	After SIXTH HOUR of 100 MPH Run	608.3	280	275	204	130	145	0.42
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	280	275	205	131	144	0.42

Amount of Oil Thrown from Box After First Five Hours 10 oz. Avg Torque (Avg, Lines 16 and 19) 0.365

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis. Secs. at: 100°F 320 ; at 210°F 53.6 ; at 0°F 28,000 ; at stabilized temp. of 280 °F: 39.6.

Viscosity Index: 98 Pour Point -20 °F Flash Point 445 °F.

STOCKS USED: Gravity°, API @ 60°F 30.1

Made up on Sept. 4, 1951 at Sun Oil Company Development Laboratory, Marcus Hook, Pa., from:
- Wholly-distilled 90 V.I. Oil (300 Viscosity)
- Pour Point Depressant: Paraflow - 1 % (depressed to -30)

REMARKS: * Maximum torque developed during acceleration to 100 MPH speed was 1.02 lbs/ton.

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 243 °F. Time Standing at 190 °F to Start of Test: 65 Hrs.

OIL: Supplied by SUN OIL COMPANY — Designation: SUN OIL "D"

DIRECTION OF ROTATION	LINE NO. REFERENCE	DATA / LOCATION IN SCHEDULE	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	125	126	122	129	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	167	171	122	129	42	0.92*
	3	After 15 Mins. at 100 MPH	33.3	221	221	126	129	92	0.60
	4	After 30 Mins. at 100 MPH	58.3	231	228	148	130	98	0.56
	5	After 45 Mins. at 100 MPH	83.3	244	240	165	130	110	0.52
	6	After FIRST HOUR of 100 MPH Run	108.3	256	251	181	131	120	0.51
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	259	255	187	131	124	0.51
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	262	258	198	131	127	0.50
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	266	262	210	130	132	0.46
	10	After SECOND HOUR of 100 MPH Run	208.3	268	265	215	130	135	0.47
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	272	267	229	130	137	0.47
	12	After THIRD HOUR of 100 MPH Run	308.3	273	270	236	130	140	0.46
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	275	272	236	130	142	0.46
	14	After FOURTH HOUR of 100 MPH Run	408.3	277	273	236	130	143	0.47
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	277	274	236	130	144	0.47
	16	After FIFTH HOUR of 100 MPH Run	508.3	277	274	235	130	144	0.47
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	271	267	198	131	136	0.31
	18	After SIXTH HOUR of 100 MPH Run	608.3	270	267	198	130	136	0.30
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	270	267	199	131	135	0.30

Amount of Oil Thrown from Box After First Five Hours 6.5 oz. Avg Torque (Avg, Lines 16 and 19) 0.385

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis. Secs. at: 100°F 186 ; at 210°F 46.3 ; at 0°F 10,000 ; at stabilized temp: of 277 °F: 37.1.

Viscosity Index: 109 — Pour Point -20 °F — Flash Point 325 °F.

STOCKS USED: — Gravity°, API @ 60°F 23.2

Made up on Sept. 4, 1951 at Sun Oil Company Development Laboratory, Marcus Hook, Pa., from:
- Wholly-distilled low pour point oil (pour, without PPD, -50°F)
- Viscosity Index Improver: To raise V.I. to 100 - Paratone, 6%

REMARKS: *Maximum torque developed during acceleration to 100 MPH speed was 0.96 lbs/ton.

SERIES 104 — TEST NUMBER 25 — DATE OF TEST RUN 3-17-52 — DATA SHEET NO. H-S - 25

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 235 °F. Time Standing at 130 °F to Start of Test: 17 Hrs.

OIL: Supplied by HUMBLE OIL & REFINING COMPANY Designation: HUMBLE SX-7892

DIRECTION OF ROTATION	LINE NO. REFERENCE	LOCATION IN SCHEDULE / DATA	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	129	131	131	130	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	152	155	131	132	23	0.81 *
	3	After 15 Mins. at 100 MPH	33.3	217	216	134	132	84	0.43
	4	After 30 Mins. at 100 MPH	58.3	233	230	139	131	99	0.38
	5	After 45 Mins. at 100 MPH	83.3	242	238	144	130	108	0.35
	6	After FIRST HOUR of 100 MPH Run	108.3	249	246	159	130	116	0.33
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	253	250	168	130	120	0.33
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	257	253	178	130	123	0.33
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	260	257	186	130	127	0.33
	10	After SECOND HOUR of 100 MPH Run	208.3	261	258	193	130	128	0.29
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	263	260	201	130	130	0.29
	12	After THIRD HOUR of 100 MPH Run	308.3	265	261	203	130	131	0.29
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	265	262	205	130	132	0.29
	14	After FOURTH HOUR of 100 MPH Run	408.3	267	263	205	130	133	0.30
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	267	265	205	131	134	0.30
	16	After FIFTH HOUR of 100 MPH Run	508.3	267	265	205	131	134	0.29
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	266	264	193	131	133	0.41
	18	After SIXTH HOUR of 100 MPH Run	608.3	266	264	196	131	133	0.41
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	266	264	196	131	133	0.41

Amount of Oil Thrown from Box After First Five Hours 9.5 oz. Avg Torque (Avg, Lines 16 and 19) 0.35

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis, Secs. at: 100°F 140 ; at 210°F 43.9 ; at 0°F 5,500 ; at stabilized temp. of 267 °F: 36.7.

Viscosity Index: 117 — Pour Point below -20 °F — Flash Point 355 °F.

STOCKS USED: — Gravity, API @ 60°F 29.8

REMARKS: *Maximum torque developed during acceleration to 100 MPH speed was 0.81 lbs/ton.

SERIES 104 TEST NUMBER 26 DATE OF TEST RUN 3-18-52 DATA SHEET NO. H-S -26

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 234 °F. Time Standing at 130 °F to Start of Test: 17 Hrs.

OIL: Supplied by HUMBLE OIL & REFINING COMPANY Designation: HUMBLE SX-7894

DIRECTION OF ROTATION	LINE NO. REFERENCE	LOCATION IN SCHEDULE / DATA	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	130	130	132	134	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	152	157	132	133	24	0.81 *
	3	After 15 Mins. at 100 MPH	33.3	207	205	133	130	75	0.52
	4	After 30 Mins. at 100 MPH	58.3	226	225	136	130	95	0.43
	5	After 45 Mins. at 100 MPH	83.3	242	240	144	130	110	0.40
	6	After FIRST HOUR of 100 MPH Run	108.3	250	248	150	130	118	0.37
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	255	253	160	130	123	0.36
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	257	255	166	130	125	0.36
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	259	257	173	130	127	0.36
	10	After SECOND HOUR of 100 MPH Run	208.3	260	258	179	130	128	0.36
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	263	261	184	130	131	0.35
	12	After THIRD HOUR of 100 MPH Run	308.3	265	263	186	130	133	0.35
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	266	264	188	130	134	0.35
	14	After FOURTH HOUR of 100 MPH Run	408.3	267	265	188	130	135	0.35
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	267	265	188	130	135	0.32
	16	After FIFTH HOUR of 100 MPH Run	508.3	267	265	188	130	135	0.32
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	265	262	193	130	132	0.43
	18	After SIXTH HOUR of 100 MPH Run	608.3	265	262	195	131	131	0.43
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	265	262	196	131	131	0.43

Amount of Oil Thrown from Box After First Five Hours 9 oz. Avg Torque (Avg, Lines 16 and 19) 0.375

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis. Secs. at: 100°F 137 ; at 210°F 42.5 ; at 0°F 6,000 ; at stabilized temp: of 267 °F: 36.2.

Viscosity Index: 104 Pour Point below -20 °F Flash Point 340 °F.

STOCKS USED: Gravity°, API @ 60°F 29.4

REMARKS: * Maximum torque developed during acceleration to 100 MPH speed was 0.84 lbs/ton.

SERIES 104 TEST NUMBER 27 DATE OF TEST RUN 3-19-52 DATA SHEET NO. H-S - 27

Association of American Railroads — Indianapolis Lubrication Laboratory

HOT - STABILIZATION ("H-S") ONE DAY SCHEDULE

5½ X 10-Inch Journal — Speed-Distance for 36-Inch Wheel — 16,375-Pound Journal Load

A.A.R Standard Journal Bearing — "Satco" Metal Lining — Depressed Back Design

Diameter of Journal 5.500-inches — Bearing Broached to Full Crown (5.500-Inch)

Waste-Pack: 9 Pounds Saturated Weight (2 Pounds Dry Waste, 7 Pounds Oil) — Saturation Ratio 3½ to 1

Waste: Laboratory Stock "SS" All-Cotton Finished Packing

Temperature of Journal at Time of Packing Box: 247 °F. Time Standing at 130 °F to Start of Test: 17 Hrs.

OIL: Supplied by RICHFIELD OIL CORPORATION Designation: RICHFIELD WR-5830-E

DIRECTION OF ROTATION	LINE NO. REFERENCE	LOCATION IN SCHEDULE / DATA	EQUIVALENT DISTANCE IN MILES	TEMPERATURES IN °F: Journal at Center	Bearing in Crown	Lubricant in Packing	Atmosphere in Room	Bearing Rise Above Atmosphere	TORQUE LBS/TON
CLOCKWISE	1	At Start of Test	0	131	132	129	129	-	-
	2	At Start of 100 MPH Run (10 Mins. After Start)	8.3	171	176	-**	134	42	0.93 *
	3	After 15 Mins. at 100 MPH	33.3	220	220	137	130	90	0.52
	4	After 30 Mins. at 100 MPH	58.3	242	238	138	130	108	0.43
	5	After 45 Mins. at 100 MPH	83.3	257	253	147	131	122	0.40
	6	After FIRST HOUR of 100 MPH Run	108.3	263	260	155	131	129	0.37
	7	After 1 Hr. and 15 Mins. at 100 MPH	133.3	267	265	161	132	133	0.36
	8	After 1 Hr. and 30 Mins. at 100 MPH	158.3	272	269	167	130	139	0.36
	9	After 1 Hr. and 45 Mins. at 100 MPH	183.3	274	270	173	130	140	0.35
	10	After SECOND HOUR of 100 MPH Run	208.3	276	273	178	130	143	0.34
	11	After 2 Hrs. and 30 Mins. at 100 MPH	258.3	278	275	184	128	147	0.33
	12	After THIRD HOUR of 100 MPH Run	308.3	279	276	189	130	146	0.33
	13	After 3 Hrs. and 30 Mins. at 100 MPH	358.3	280	277	190	130	147	0.32
	14	After FOURTH HOUR of 100 MPH Run	408.3	282	280	192	131	149	0.33
	15	After 4 Hrs. and 30 Mins. at 100 MPH	458.3	283	281	195	131	150	0.33
	16	After FIFTH HOUR of 100 MPH Run	508.3	284	281	196	131	150	0.33
COUNTER-CW	17	After 5 Hrs. and 30 Mins. at 100 MPH	558.3	278	276	187	131	145	0.45
	18	After SIXTH HOUR of 100 MPH Run	608.3	278	276	188	132	144	0.45
	19	After 6 Hrs. and 30 Mins. at 100 MPH	658.3	278	276	187	128	148	0.43

Amount of Oil Thrown from Box After First Five Hours 4.5 oz. Avg Torque (Avg, Lines 16 and 19) 0.38

ANALYSIS AND DESCRIPTION OF OIL AS TESTED

S.U. Vis. Secs. at: 100°F 270 ; at 210°F 50.0 ; at 0°F 24,000 ; at stabilized temp. of 284 °F: 37.7.

Viscosity Index: 91 — Pour Point below -20 °F — Flash Point 340 °F.

STOCKS USED: — Gravity°, API @ 60°F 25.5

Modified Richfield Car Oil 6W WR 5830-E made up at Watson Laboratory, Los Angeles, California.

Stocks are:

- Car Oil 6W - 95% ***
- Plexol 244 - 5%

*** (Specification dated Aug. 13, 1951 for Richfield Car Oil 6W is as follows:

- 200 Lube Distillate - 26%
- 58/60 WDD Stock - 74%
- Oil of Myrbane - 0.0625)

REMARKS: * Maximum torque developed during acceleration to 100 MPH speed was 0.96 lbs/ton.

** Thermocouple inoperative - replaced before next reading.

SERIES 104 TEST NUMBER 28 DATE OF TEST RUN 3-20-52 DATA SHEET NO. H-S - 28

PART II. SECTION 1

VAPORIZATION OF CAR JOURNAL OIL OF PRESENT AAR SPECIFICATION COMPARED TO A "LIGHTER" 40-42 SECOND VISCOSITY OIL (MRP-6.2)

OBJECT OF TEST

At a meeting of the Joint Subcommittee on Journal Lubrication Research, January 17, 1952, it was recommended that the Mechanical Research Department further investigate the above subject, using a full scale machine and a tight journal box. The Committee on Lubrication of Cars and Locomotives approved this recommendation at the meeting of February 13, 1952, and the Committee on Specifications for Materials approved it at the meeting ending February 28, 1952. A progress report on the subject, dated October 9, 1952, was furnished to all Committees concerned, and a final report was issued dated February 24, 1953.

The final report was submitted as a progress report, but was complete in all details presented herein except that the graphs shown in Figures 1, 2 and 3 have been added to this report.

PROCEDURE

Four tests of equal simulated mileage, using two oils and two separate conditions, were run on the full size journal "pilot" machine located at the Central Research Laboratories. A description and sketch of the machine is on page 15 of this report. The design of this machine permits only a token load, but the load was the same for all tests, and was considered satisfactory for the purpose intended as the primary object of the test was to obtain the effect of journal heat on vaporizing oil.

The simulated speed and mileage was for a 33" wheel, and it was found that 40 miles per hour on the machine produced running temperatures similar to those

that are encountered in service and that were satisfactory for the purpose of the test. In addition to speed, time and mileage - journal, bearing, packing, ambient, and sometimes other temperatures were recorded. Wind conditions were simulated by two fans blowing against the side of the journal box, one near the lid and one near the dust guard end. This condition was always constant.

All tests were usually run on a 16-hour basis for running time, and eight hours shut down overnight. This resulted in fluctuating temperatures as might be found in service. The ambient temperature was controlled to not exceed 130°F. while running. Once during each test, at 5000 miles, the entire day's run was in dropping ambient temperature to approximately 20°F. below zero. Each test required approximately one month to run on the machine.

Each oil was tested under the tight fitting journal box condition, and each under loose fitting conditions. The tight fitting box was obtained by the use of a certified box lid and a Railway Service & Supply Corporation dust guard. The loose condition employed a worn and battered wooden dust guard. The box lid spring was removed and the lid caused to flop by means of a cam mechanism which knocked the lid open 3/16" at the bottom about every 2 seconds, or 400,000 times during each test.

Changes in the physical characteristics of the oils used were determined by analyses before and after tests in order to record significant changes in viscosity, moisture, etc. The contents of the waste packs were carefully weighed in grams before each test, and losses from the box carefully recorded. Inasmuch as analyses indicated no reason for weight change other than moisture, the loss in weight due to vaporization was assigned by subtracting known losses from the box, plus gain due to moisture content at end of test.

The conditions of the tests are shown in Table I, with photographs of the loose lid set-up. Characteristic temperatures employed are shown graphically by Figures 1, 2 and 3.

RESULTS OF TESTS

The results of the tests are shown in the following exhibits:

Table II	Losses in Weight of Waste Pack Contents
Table III	Oil Analyses
Table IV	Temperature Conditions

DISCUSSION OF RESULTS

Based upon the comparative laboratory tests results, the oil lost due to vaporization of the "lighter" oil (40 - 42 vis. at 210°F.) is a considerable factor compared to the present emergency specification oil. Free oiling of boxes at terminals is sufficiently frequent to make remote any danger of insufficient oil. The fact that the lower viscosity oil vaporizes at a higher rate results in an oil loss which, when constantly replaced, increases the total oil consumption in journal boxes.

Loose lid conditions increase vaporization if same temperature conditions are encountered.

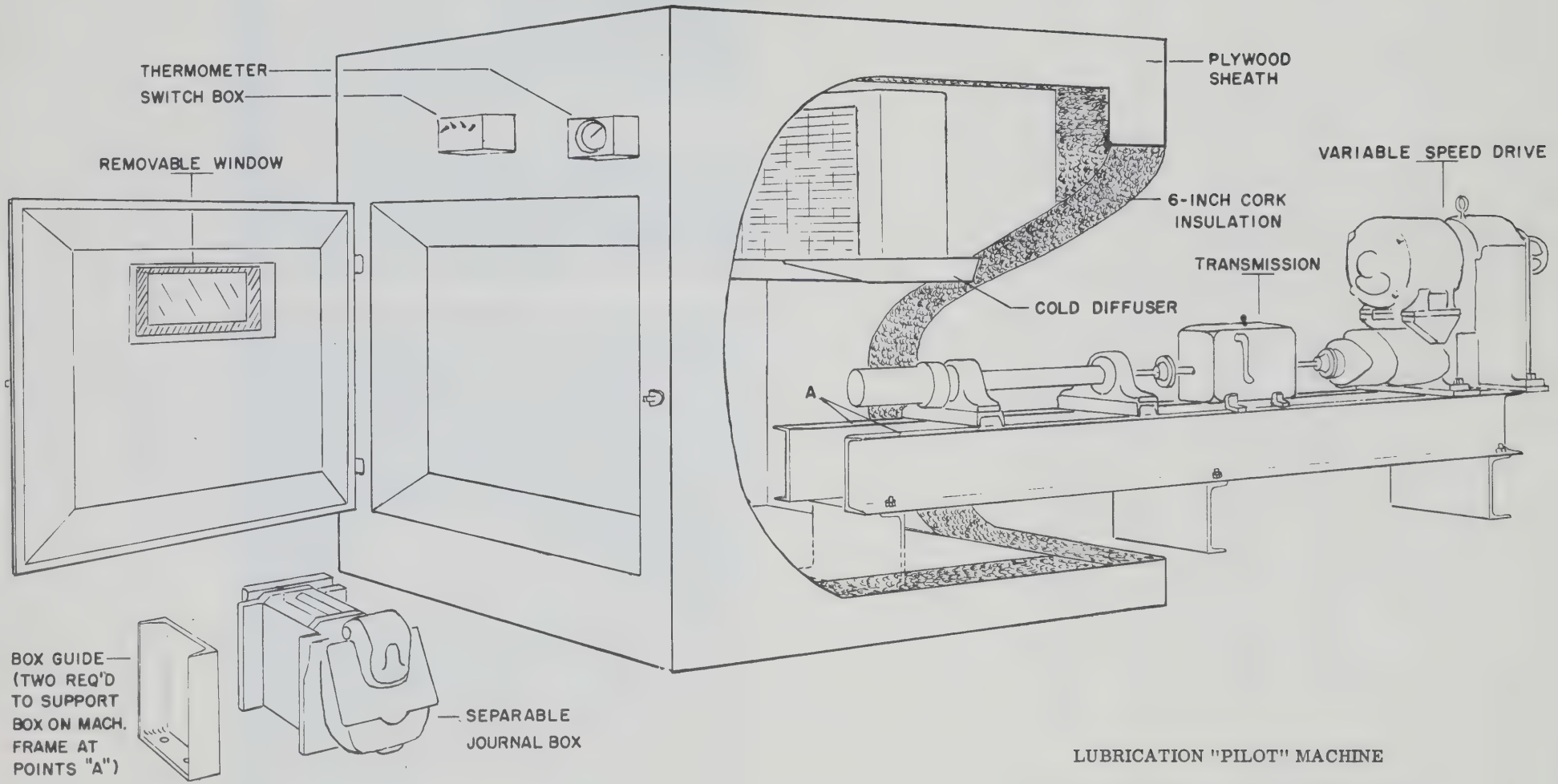
SPEED: Simulated speed based on 33-inch wheel, ranges from 4.5 to 100 mph

TEMPERATURE RECORDING: Temperatures can be taken from any desired location by thermocouples and are recorded by means of Brown Electronic Potentiometer Pyrometer

REFRIGERATION: Refrigeration is accomplished by three-ton freon unit.

TEMPERATURE: Range of temperature within insulated room is -40°F to 300°F.

OBSERVATION WINDOW: Insulated glass panel in door permits viewing of test conditions. Panel may be removed to allow insertion of motion picture or still photographic equipment into chamber to record action of materials under test.



LUBRICATION "PILOT" MACHINE

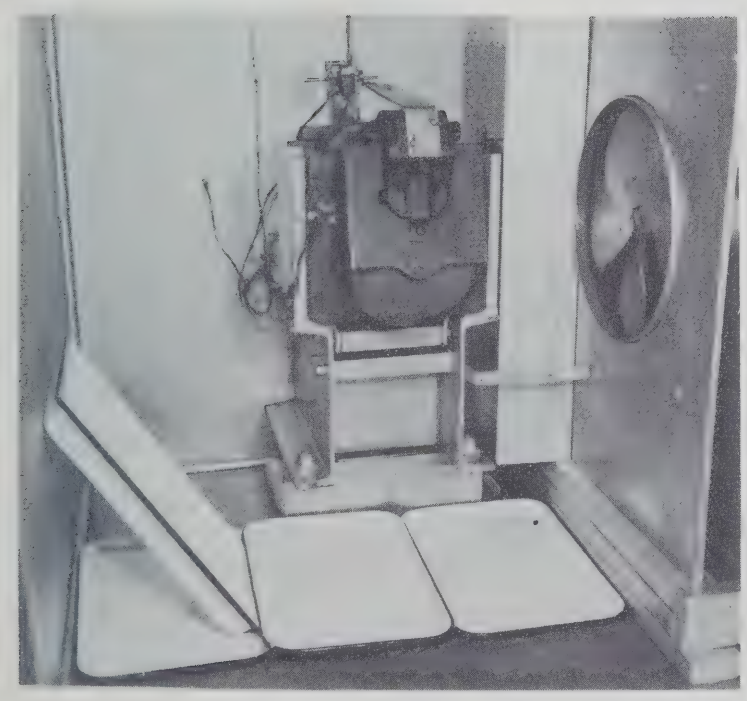
Located at Central Research Laboratory, Chicago

f9100-15

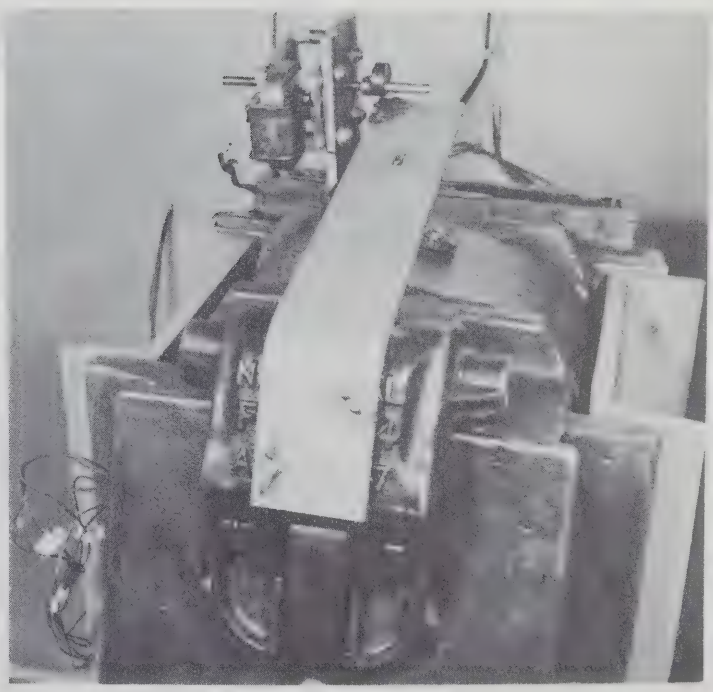
Table I

TEST CONDITIONS

Test Number I	- Using proposed specification journal box oil and employing a tight journal box.
Test Number II	- Using Association of American Railroads Emergency Specification car journal oil and employing a tight box.
Test Number III	- Using proposed specification journal box oil and employing a worn dust guard and loose lid.
Test Number IV	- Using Association of American Railroads Emergency Specification car journal oil and employing a worn dust guard and loose lid.



Photograph showing the pans for catching lost and thrown oil, and the fan arrangement. Another fan and pan is further to the rear.



Photograph showing the electric cam arrangement used to simulate flopping loose lid.

TABLE II

LOSS IN WEIGHT OF PACKING CONTENT

	Type of Oil	Total Loss of Weight of Waste Pack Grams - Percent	Loss of Oil Accounted for Grams - Percent	Moisture Accumulated in Waste at End of Test	Oil lost by Vaporization Grams - Percent
Test I Tight Box	Proposed Specification 40 - 42 VIS.	510 - 12.5	128 - 4	9.07 gms.	391 - 12.3
Test II Tight Box	AAR Specification EM - 906 - 50 50 - 55 VIS.	260 - 6.35	185 - 5.9	7.26 gms.	82 - 2.58
Test III Loose Box	Proposed Specification 40 - 42 VIS.	531 - 13.0	113 - 3.6	3.63 gms.	422 - 13.3
Test IV Loose Box	AAR Specification EM - 906 - 50 50 - 55 VIS.	174 - 4.25	90 - 2.84	3.08 gms.	87 - 2.74

WEIGHT OF PACK AT START OF EACH TEST

Waste - - - - - - - - - 902 Grams (oven dried)
Oil - - - - - - - - - 3175 Grams
Total - - - - - - - - - 4082 Grams (9 pounds)

f9100-17

TABLE III

RESULTS OF OIL AND WASTE ANALYSIS BEFORE AND AFTER TESTS

			TEST 1		TEST 2		TEST 3		TEST 4	
			"TIGHT" LID - "TIGHT" DUST GUARD				"LOOSE" LID - DISTORTED DUST GUARD			
			PROPOSED SPEC. OIL		AAR SPEC. EM-906-50		PROPOSED SPEC. OIL		AAR SPEC. EM-906-50	
			BEFORE TEST	AFTER TEST	BEFORE TEST	AFTER TEST	BEFORE TEST	AFTER TEST	BEFORE TEST	AFTER TEST
OIL	VISCOSITY S.U.S.	at 100°F	126.4	162.3	323.4	328.9	126.4	163.6	323.4	322
		at 210°F	40.85	43.50	52.74	52.77	40.85	43.57	52.74	52.7
	VISCOSITY INDEX		83	88	92	89	83	85	92	91
	POUR POINT		-35	-35	-25	-25	-35	-35	-25	-25
	FLASH POINT		370	360	390	405	370	360	390	425
	MOISTURE, %		TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
	TARRY MATTER, %		0.004	0.009	0.007	0.006	0.004	NONE	0.007	0.001
	INSOLUBLE IMP.		0.015	0.036	0.013	0.071	0.015	0.044	0.013	0.049
	ACIDITY		NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL
WASTE	MOISTURE CONTENT, %		OVEN-DRIED	1.0	OVEN-DRIED	0.8	OVEN-DRIED	0.4	OVEN-DRIED	0.34

f9100-18

TABLE IV

COMPARISON OF AVERAGE OPERATING TEMPERATURES

	CONDITION OF BOX LID AND DUST GUARD	TYPE OF OIL USED	TEMPERATURES, °F.										
			HOT RUN						COLD RUN				
			AMB-IENT	BEARING		JOURNAL BOX			MINIMUM AMB-IENT	BRG. STABI-LIZED	JOURNAL BOX		
				STABI-LIZED	MAX.	LID	SIDE	AIR			LID	SIDE	AIR
TEST 1	TIGHT LID & DUST GUARD	PROPOSED SPECIFICATION (42 VIS.)	130°	243°	254°	NOT MEASURED			-16.5°	161°	NOT MEASURED		
TEST 2		SPECIFICATION EM-906-50	130°	228°	244°	137°	142°	NOT MEASURED	-18	165°	NOT MEASURED	-2°	3°
TEST 3	"FLOPPING" LID & DISTORTED DUST GUARD	PROPOSED SPECIFICATION (42 VIS.)	130°	200°	203°	134°	140°	NOT MEASURED	-16	136°	-1°	1°	NOT MEASURED
TEST 4		SPECIFICATION EM-906-50	130°	222°	229°	136°	141°	163°(1) 157°(2) 148°(3) 167°(4)	-21	164°	-10°	-2°	47°(1)

(1) Air temperature measured in top area of journal box immediately in front of bearing.
(2) Air temperature measured in center box area opposite center hole of journal shaft.
(3) Air temperature measured in lower box area immediately in front of waste-pack.
(4) Air temperature measured in no.(2) position after running 3 hours with lid closed.

f9100-19

FIGURE 1, PART II

CHARACTERISTIC CURVE SHOWING AVERAGE TEMPERATURES EMPLOYED DURING TEST I USING 40-42 VISCOSITY OIL

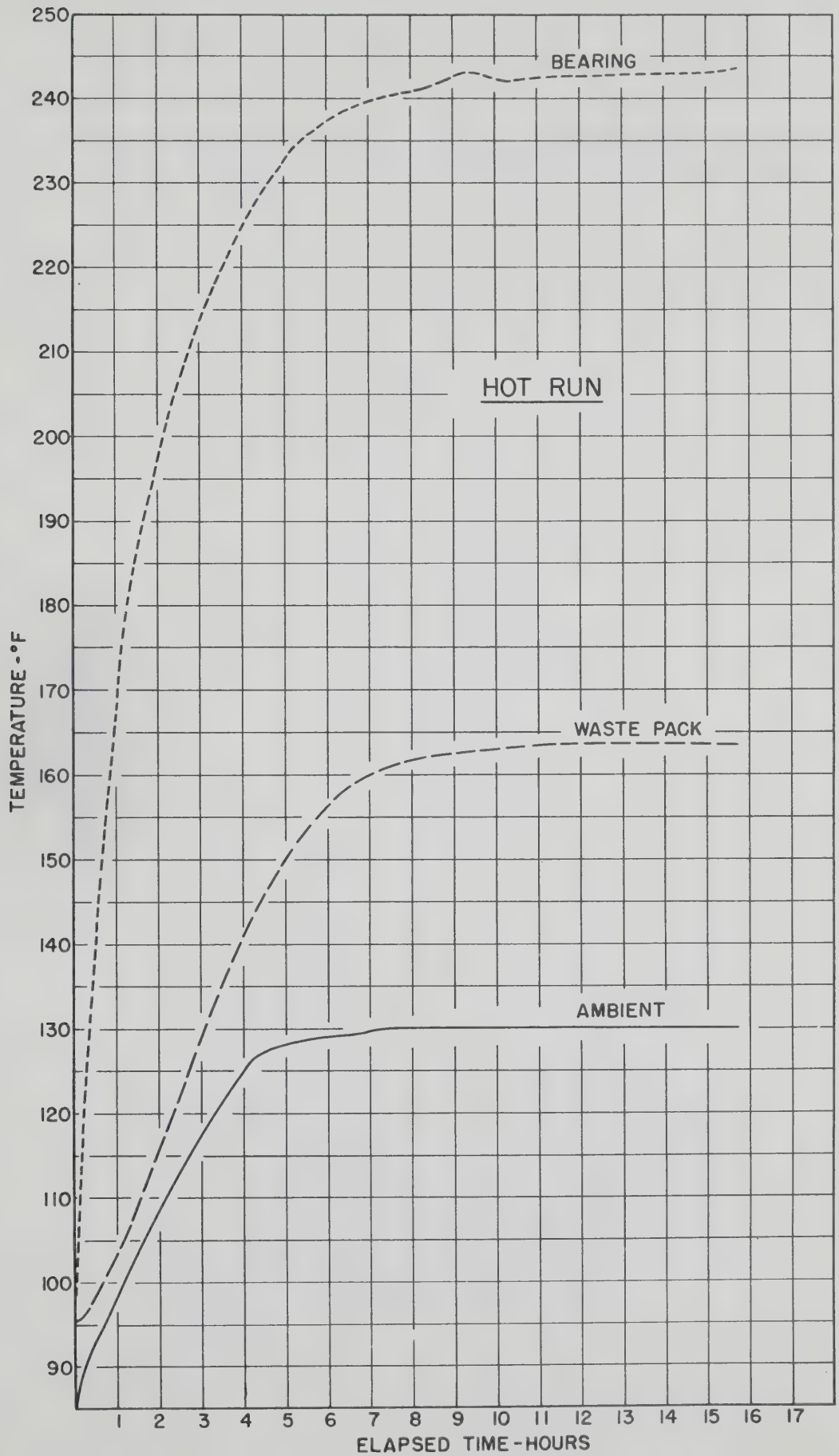


FIGURE 2, PART II

CHARACTERISTIC CURVE SHOWING AVERAGE TEMPERATURES EMPLOYED DURING TEST I USING 40-42 VISCOSITY OIL

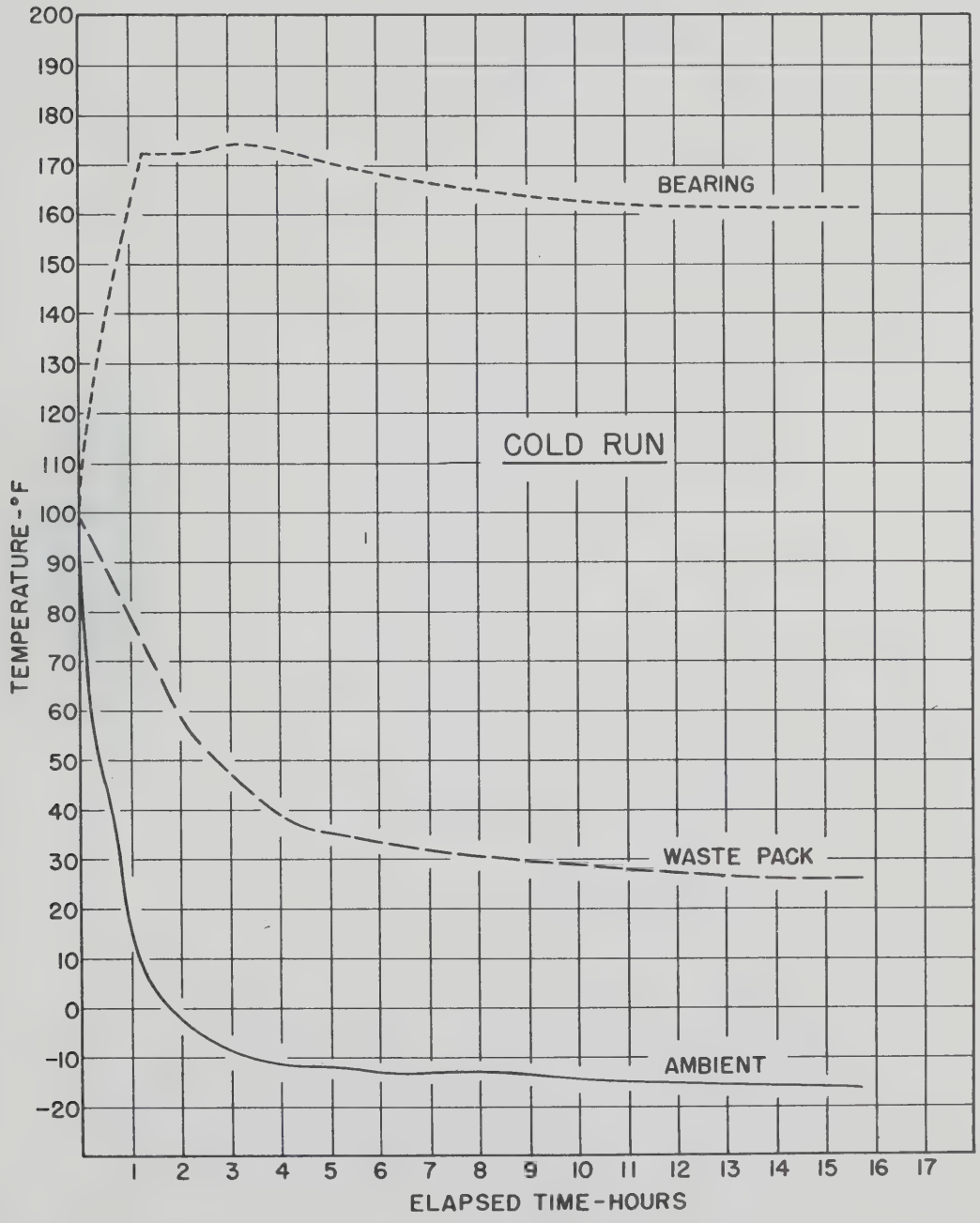
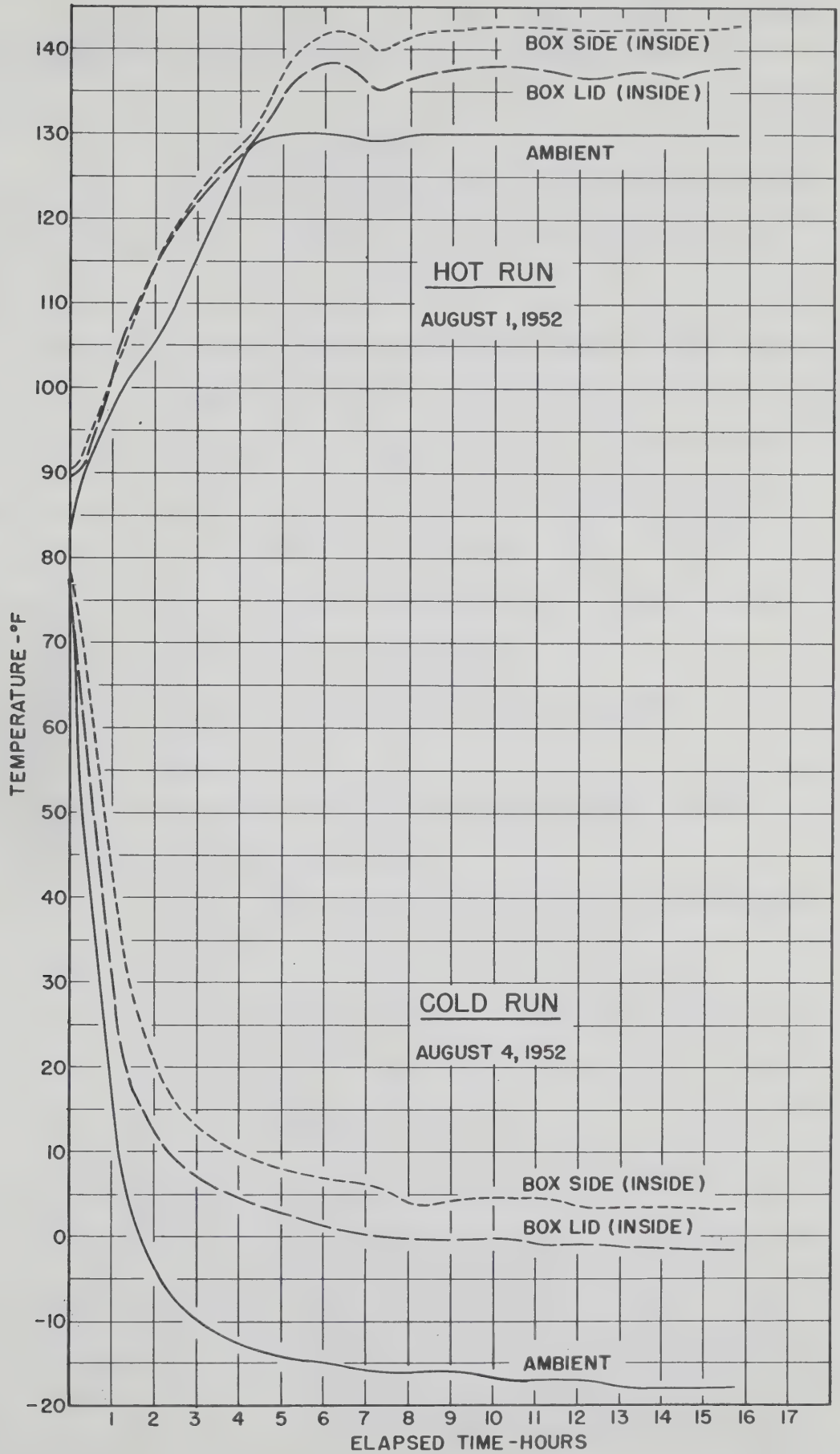


FIGURE 3, PART II

SAMPLE RUNS SHOWING RELATIVE TEMPERATURES USING PRESENT EMERGENCY SPECIFICATION OIL, 50-55 VISCOSITY



PART II. SECTION 2

VAPORIZATION OF CAR JOURNAL OIL OF PRESENT AAR SPECIFICATION COMPARED TO A "LIGHTER" 40-42 SECOND VISCOSITY OIL (MRP-6.1)

OBJECT OF THE TEST

Supplementing Section 1, Part II, further vaporization tests were conducted at the Central Research Laboratories by employing open vessels of oil in controlled temperature.

An incidental result of Mechanical Research Project 5, which is Part VI of this Report, indicated considerable loss of 40-42 second viscosity oil during a test period of a simulated 25,000 miles in freight service. As we were unable to assign any reason for this oil loss other than vaporization, laboratory tests were conducted at Central Research Laboratories to determine if such loss resulted from vaporization. The same oils used during Mechanical Research Project 5 were used for these open vessel tests and are as follows:

Oil I - EM-904-50, Railway Service and Supply Corp. Renovated stock car journal oil.

Oil II - 50-50% Mixture of RS&SC Renovated Car journal oil, and Bayou States 57 Neutral - No additives.

Oil III - Same as Oil II, but with 0.50%, by weight, MS-40 additive from Burns Laboratory.

The principal characteristics of these oils is shown in Table II of this section.

PROCEDURE

A sample of each of the three oils, in amounts normally contained in the packing of a $5\frac{1}{2}$" x 10" car journal box, was placed in the same controlled temperature oven in three separate containers. The oven was force-ventilated, but the oil was not agitated. Photographs of the laboratory equipment and test set-up are shown on page 25.

The oven temperature was automatically controlled at 200°F. for the duration of the test which was 312 hours, or 13 days. The test was discontinued when the rate of vaporization was decreasing, but was not complete. The trend, however, is apparent.

The weights of the oils were carefully noted at the start of the test, at regular intervals, and at the finish of the test. Table I of this section shows the rate of vaporization.

Laboratory analyses were made of the oils at the start and completion of the test. The results and changes in analysis as a result of encountering the temperature condition imposed are shown in Table II of this section.

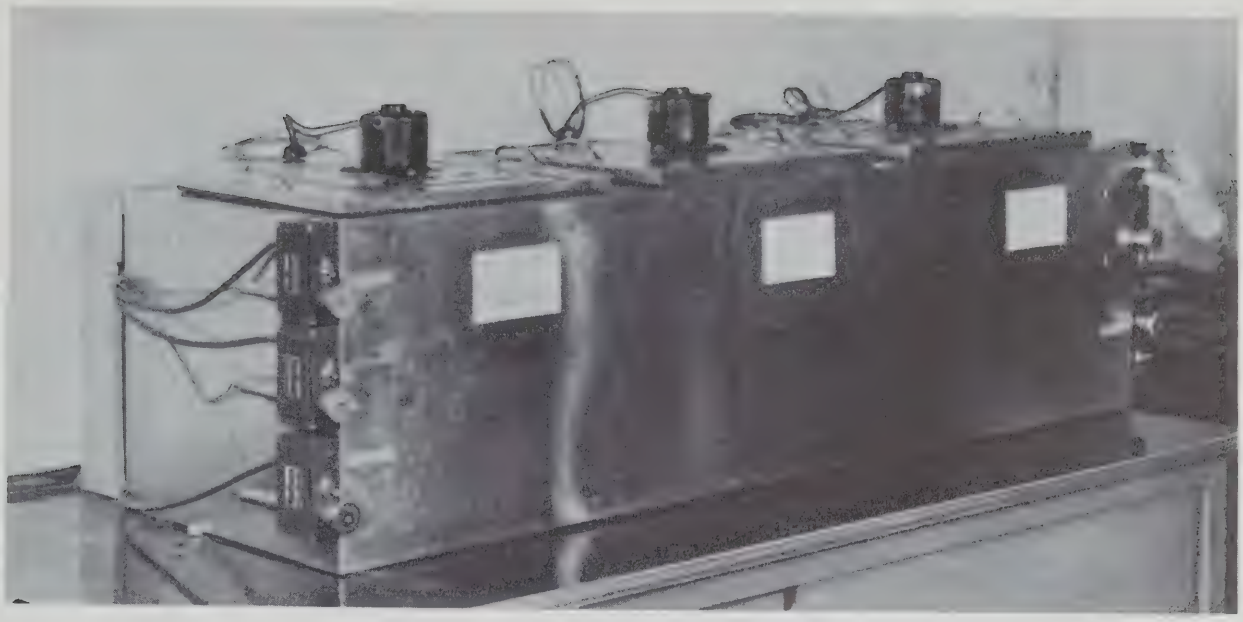
DISCUSSION OF RESULTS

Based upon the results of this laboratory test, the following conclusions are apparent:

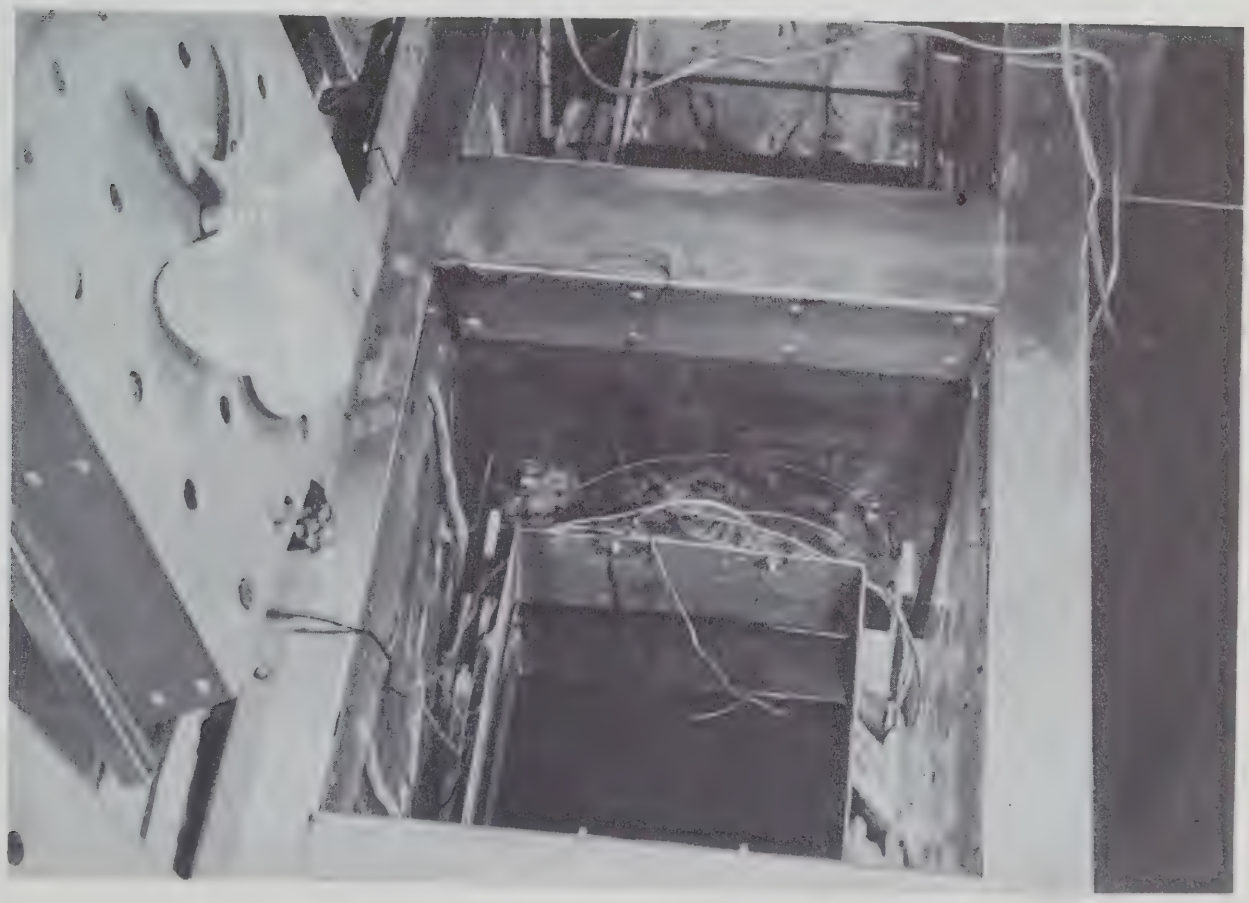
1. The principal loss of oil (Maximum 35.8%), noticed during Mechanical Research Project 5, Part VI, was due to vaporization.
2. The early decrease of excess oil feed during Mechanical Research Project 5 - was principally due to vaporization.
3. The vaporization of the lower viscosity journal oils is of considerable consequence as a loss in percent.
4. Vaporization results in raising the viscosities, and flash, fire and pour point.

The rate of vaporization decreased as the test progressed. No determination was made in regard to stabilization of the rate, or as to the effect of cooling and reheating the oils.

There is no definite evidence that the MS-40 additive affected vaporization, and the effect of vaporization upon either MS-40 itself, or any of its functions was not determined.



CONTROLLED TEMPERATURE OVEN USED IN VAPORIZATION TEST.



LOOKING DOWN INTO CONTROLLED TEMPERATURE OVEN WITH LIDS OPEN, SHOWING OIL PANS AND VENTILATING FANS.

SECTION 2 OF PART III

TABLE NO. I

EVAPORATION DATA

	PERIOD	TIME	DATE	ELAPSED HOURS		NET WEIGHT OF OIL		LOSS OZ.	LOSS PERIOD %	LOSS TOTAL %	LOSS PERIOD %/HR.
				PERIOD	TOTAL	LBS.	OZ.				
	START	10:00 AM	1-24-52	0	0	6	8.75	0	0	0	0
	1ST	"	1-28-52	96	96	6	5.89	2.86	2.73	2.73	.0284
OIL NO. I	2ND	"	2-1-52	96	192	6	3.76	1.93	1.90	4.58	.0197
	3RD	"	2-4-52	72	264	6	2.75	1.21	1.21	5.73	.0168
	FINISH	"	2-6-52	48	312	6	1.96	.0.79	0.80	6.50	.0167
	START	10:00 AM	1-24-52	0	0	6	8.58	0	0	0	0
	1ST	"	1-28-52	96	96	6	0.99	7.59	7.26	7.26	.0756
OIL NO. II	2ND	"	2-1-52	96	192	5	12.18	4.81	4.95	11.70	.0515
	3RD	"	2-4-52	72	264	5	9.34	2.84	3.08	14.61	.0422
	FINISH	"	2-6-52	48	312	5	7.77	1.57	1.68	16.1	.0350
	START	10:00 AM	1-24-52	0	0	6	8.57	0	0	0	0
	1ST	"	1-28-52	96	96	6	0.60	7.97	7.62	7.62	.0793
OIL NO. III	2ND	"	2-1-52	96	192	5	11.97	4.63	4.80	11.70	.0500
	3RD	"	2-4-52	72	264	5	8.76	3.21	3.50	14.80	.0486
	FINISH	"	2-6-52	48	312	5	7.49	1.27	1.43	16.30	.0298

TABLE NO. II

PROPERTIES OF OILS TESTED

	SAMPLE AT	S.U. VISCOSITY 210°F	S.U. VISCOSITY 100°F	FLASH °F	FIRE °F	POUR °F	VISC. INDEX	VISC. 0°F EXTRAP'D
OIL NO. I	START	48.75	259.5	347	392	-20	81.5	25000
	FINISH	54.73	379.8	375	425	-15	82	55000
	CHANGE	+5.98	+120.3	+28	+33	+ 5	+0.5	+30000
OIL NO. II	START	39.85	119.3	295	333	-40	59	6000
	FINISH	43.63	179.8	343	373	-30	65.5	14000
	CHANGE	+3.98	+60.5	+48	+40	+10	+3.5	+8000
OIL NO. III	START	40.50	125.1	292	335	-35	65	6000
	FINISH	42.79	168.6	340	375	-30	54	12000
	CHANGE	+2.29	+43.5	+48	+40	+ 5	-11	+6000

PART III

LABORATORY STUDY OF BEARING TEMPERATURES AS AFFECTED BY JOURNAL BOX PACKING PRESSURES ON JOURNALS (MRP-14)

OBJECT OF THE TEST

The object of the test was to determine the nature of bearing temperature rise due to waste-pack pressure on the journal, and to compare this effect when using car journal oils of different specifications.

The test was conducted at the Central Research Laboratories, using the half-scale, 8-journal testing machine. This machine is described in several previous progress reports, and its description will not be repeated herein.

Two oils were used: one meeting the A.A.R. specification for new car journal oil, EM-906-50; the other meeting the A.A.R. proposed specification for renovated car journal oil of 40-42 seconds viscosity at 210°F. A good quality all-cotton waste was used.

The principal characteristics of the two oils are:

	OIL I	OIL II
Source	Sinco 53	R.S. and S.C.
Specification	EM-906-50	Proposed
S.U. Viscosity at 210°F.	52.74 Sec.	40.85 Sec.
S.U. Viscosity at 100°F.	323.4 Sec.	126.4 Sec.
Viscosity Index	92	83
Flash Point (open cup)	390°F.	370°F.
Pour Point, °F.	-25	-35
Additive	-	0.5% MS-40

PROCEDURE

A base-line stabilized bearing temperature for the test machine was established when using no packing at all. Lubrication was accomplished in the stabilizing procedure by means of bulb syringes operated by hand. Thence, the waste packs were employed at known pressures against the journals, and the pressures were increased by uniform increments and at uniform intervals. From these results, curves were established for comparison, and are shown in Figure 1 of Part III. The bearing loads of 50 pounds and the waste pack contact areas were constant, but do not simulate the higher actual pressures of car journal box assemblies in service. They are, however, comparative for each of the variables of the test. In order to eliminate variable conditions, the excess feed measuring equipment of the machine was not used. The oil flow outlets were sealed.

The waste packs were saturated and applied in accordance with the long-established W-O schedule procedure, described in previous reports, and were allowed to stand in the cellars overnight with the shims applied for uniform volume. This established a form-fitting contact of packing to the journal.

Waste pack pressure was obtained by means of weight application through the standard leverage for this purpose attached to the cellars, and were varied by adding known weights of shot into the loading receptacles. (See photograph, page 31) A weight of 2.92 pounds at the end of the lever was required to balance the combined weight of the cellar and waste packs. As weights were added, the upward thrust resulted in the total pressure of the waste pack against the journal. Any attempt to convert this total waste-pack pressure into pounds per square inch of contact was discarded as impractical. Table A, pages 32 and 33 shows the complete log with pressure applied using present specification journal oil, and Table B, pages 34 and 35 shows the same data when using the proposed specification oil. Table C, page 36 shows the log sheets when bringing the bearing temperatures to approximate stabilization with no waste pack or pressure applied.

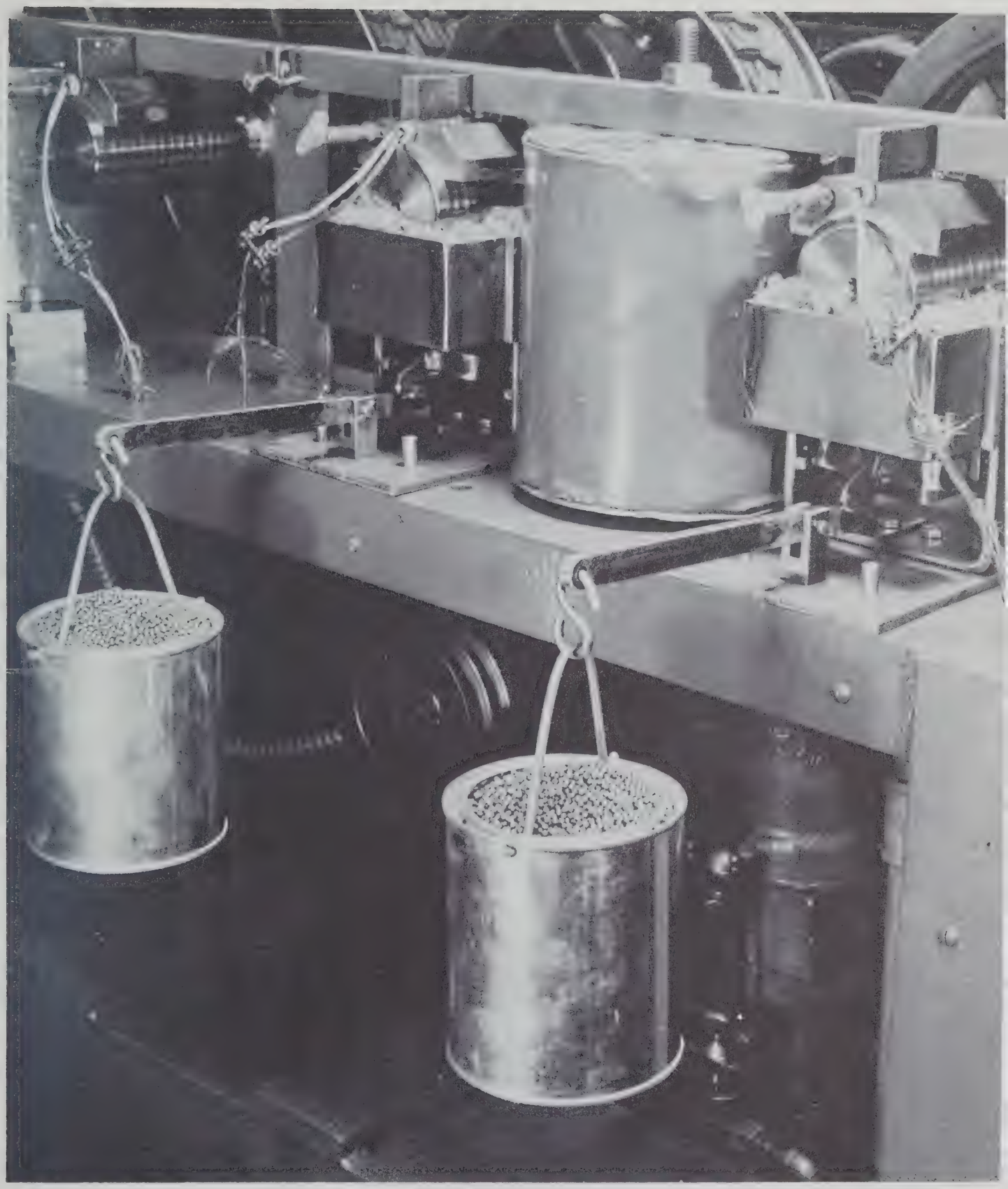
DISCUSSION OF RESULTS

From the graphs shown in Figure 1, page 37 the following observations can be made on these data:

(a) Bearing temperatures increase directly with waste pack pressures, the curve approaching a straight line, constant at the higher packing pressures.

(b) The curve of the rise of bearing temperatures is parallel for the two oils used, indicating that the temperature rise is proportional with either oil, but independent of oil characteristics.

(c) Bearing temperature due to waste pack pressure is a significant proportion of the total temperature at the bearing.



VIEW OF 8-JOURNAL MACHINE PARTIALLY SET UP FOR WEIGHT APPLICATION.

TABLE A

MRP-14

LOG OF BEARING TEMPERATURES USING OIL NO. I
PRESENT AAR SPECIFICATION

WEIGHT ON LEVER LBS.	TOTAL LBS WASTE-PACK PRESSURE ON JOURNAL	TIME	Amb. Temp. °F.	BEARING TEMPERATURE, °F									
				Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Average	Rise Above Ambient
3.5	3.38	8:30AM	85	85	85	85	85	85	85	85	85	85	0
		8:45	85	145	146	145	146	151	139	152	149	146.7	61.8
		9:00	85	155	153	152	154	161	152	162	158	156	71.0
		9:15	84	156	154	153	155	165	154	165	161	158	74.0
		9:30	83	156	154	154	155	167	156	169	163	159.2	76.2
		9:45	83	157	154	155	156	167	158	170	165	160.2	77.2
7	9.68	10:00	83	158	154	155	157	167	158	170	165	160.5	77.5
		10:15	83	159	157	158	162	172	163	173	170	164.2	81.2
		10:30	83	160	157	160	164	173	165	174	171	165.2	82.2
		10:45	83	160	157	160	165	173	167	175	172	166	83.0
8	11.48	11:00	83	160	157	160	165	173	167	175	172	166	83.0
		11:15	83	161	159	161	167	174	169	177	173	167.7	84.7
		11:30	83	161	159	161	168	175	169	177	173	168	85.0
		11:45	83	162	159	161	168	175	170	178	173	168.2	85.2
9	13.28	12:00	83	162	159	161	168	175	170	178	173	168.2	85.2
		12:15PM	83	163	160	163	168	176	172	178	174	170.5	87.5
		12:30	83	163	160	163	168	177	173	179	175	171	88
		12:45	83	163	160	163	169	177	173	179	175	171	88
10	15.08	1:00	83	163	160	163	169	177	173	179	175	171	88
		1:15	83	166	163	165	171	180	176	179	178	172.2	89.2
		1:30	83	166	163	165	171	181	177	180	180	172.9	89.9
		1:45	83	167	164	166	171	182	177	180	180	173.4	90.4
11	16.88	2:00	83	167	164	165	171	182	177	180	180	173.2	90.2
		2:15	83	168	165	168	172	184	180	181	182	175	92
		2:30	83	169	165	169	173	187	179	182	183	175.8	92.8
		2:45	83	170	165	169	173	187	180	182	183	176.1	93.1
12	18.68	3:00	83	170	165	168	173	187	180	182	183	176	93
		3:15	83	170	165	167	173	187	180	182	183	176.1	93.1
		3:30	83	170	165	167	175	188	181	183	184	176.6	93.6
		3:45	83	170	165	167	175	188	181	183	184	176.6	93.6
13	20.48	4:00	83	170	165	167	175	188	181	183	184	176.6	93.6
		4:15	83	171	166	167	175	187	181	183	184	176.9	93.8
		4:30	83	171	166	168	175	187	182	183	184	177	94
		4:45	83	171	166	168	175	189	184	185	185	177.9	94.9

TABLE A (CONT.)

MRP-14

LOG OF BEARING TEMPERATURES USING OIL NO. I
PRESENT AAR SPECIFICATION

WEIGHT ON LEVER LBS.	TOTAL LBS WASTE PACK PRESSURE ON JOURNAL	TIME	Amb. Temp. °F	BEARING TEMPERATURE, °F.									
				Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Average	Rise Above Ambient
14	22.28	5:00PM	83	172	167	168	175	189	185	185	186	178.4	95.4
		5:15	82	173	168	170	175	190	187	198	188	179.4	97.4
		5:30	82	173	168	170	175	190	188	188	188	180	98
		5:45	82	173	168	170	175	191	188	188	188	180.1	98.1
15	24.08	6:00	82	173	168	170	175	191	188	188	188	180.1	98.1
		6:15	82	174	170	171	176	193	189	189	189	181.4	99.4
		6:30	82	174	170	171	176	193	189	189	189	181.4	99.4
		6:45	82	175	170	171	176	193	190	190	190	181.9	99.9
16	25.88	7:00	83	175	170	171	176	193	190	190	190	181.9	98.9
		7:15	83	175	170	172	177	193	190	190	190	182.1	99.1
		7:30	83	175	170	173	177	193	190	190	190	182.4	99.4
		7:45	83	175	170	173	178	193	190	190	190	182.4	99.4
17	27.68	8:00	83	176	170	173	178	193	190	190	190	182.5	99.5
		8:15	83	177	171	174	179	193	191	191	191	183.4	100.4
		8:30	82	178	171	174	180	193	192	192	191	183.9	101.9
		8:45	82	178	172	175	180	193	192	192	191	184.1	102.1
18	29.48	9:00	82	179	173	175	180	193	192	193	192	184.6	102.6
		9:15	82	179	175	175	181	194	191	193	192	185	103
		9:30	82	180	175	178	183	195	193	195	192	186.5	104.5
		9:45	83	183	175	178	184	196	194	196	194	187.5	104.5
19	31.28	10:00	84	185	175	178	184	196	194	196	194	187.7	103.7
		10:15	84	186	176	180	187	196	194	197	195	189	105
		10:30	84	187	177	180	187	196	195	197	195	189.2	105.2
		10:45	85	187	177	180	187	196	195	198	195	189.5	104.5
20	33.07	11:00	85	190	177	181	187	196	195	198	195	190	105
		11:15	85	191	177	182	188	196	196	198	196	190.5	105.5
		11:30	85	191	177	182	188	196	197	199	196	190.7	105.7
		11:45	85	191	178	183	188	196	198	200	197	191.5	106.5
		12:00	85	192	178	185	189	196	198	200	197	192	107
		END OF RUN.											

TABLE B

MRP-14

LOG OF BEARING TEMPERATURES USING OIL NO. II
PROPOSED AAR SPECIFICATION

WEIGHT ON LEVER LBS.	TOTAL LBS WASTE-PACK PRESSURE ON JOURNAL	TIME	Amb. Temp. °F	BEARING TEMPERATURE, °F.									
				Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Average	Rise Above Ambient
3.5	3.38	8:30AM	80	80	80	80	80	80	80	80	80	80.0	0
		8:45	80	125	125	122	122	130	120	130	127	125.0	45.0
		9:00	81	136	132	130	132	141	134	140	137	135.3	54.3
		9:15	82	140	135	133	135	146	140	145	142	139.5	57.3
		9:30	82	141	136	135	136	148	143	147	145	141.4	59.3
		9:45	82	142	137	136	137	148	145	148	146	142.4	60.3
7	9.68	10:00	82	144	138	136	137	150	146	150	147	143.5	61.5
		10:15	82	146	142	142	143	155	151	153	152	148.0	66.0
		10:30	82	147	145	144	145	155	153	155	154	149.8	67.8
		10:45	82	148	145	145	145	156	154	155	155	150.4	68.3
8	11.48	11:00	82	148	145	145	146	156	155	155	156	130.8	68.8
		11:15	82	149	146	146	148	159	156	157	158	152.4	70.3
		11:30	82	150	146	147	148	159	158	158	159	153.0	71.0
		11:45	82	150	146	147	149	160	159	159	160	153.8	71.8
9	13.28	12M	82	150	146	147	149	160	159	159	161	153.9	71.9
		12:15PM	82	152	149	149	151	161	160	160	161	155.4	73.3
		12:30	82	152	149	149	151	162	160	160	162	155.6	73.8
		12:45	82	154	149	149	150	162	160	160	162	155.8	73.8
10	15.08	1:00	82	154	149	149	150	162	160	160	162	155.8	73.8
		1:15	82	155	150	150	153	165	162	162	165	157.4	75.3
		1:30	82	155	150	150	153	165	162	163	167	157.8	75.8
		1:45	82	155	150	150	154	165	163	163	165	158.1	76.1
11	16.88	2:00	82	155	150	150	155	166	163	163	165	158.4	76.3
		2:15	82	156	152	151	156	169	164	164	166	159.8	77.8
		2:30	82	159	153	153	156	169	165	165	166	160.8	78.8
		2:45	82	159	153	153	156	169	165	165	166	160.8	78.8
12	18.68	3:00	82	159	153	153	157	170	165	165	167	161.1	79.1
		3:15	82	160	154	154	157	170	165	165	168	161.6	79.8
		3:30	82	160	154	154	158	170	166	166	168	162.0	80.0
		3:45	82	160	153	153	158	170	166	166	168	161.8	79.8
13	20.48	4:00	82	161	154	154	159	170	166	166	169	162.3	80.3
		4:15	82	161	154	154	160	170	166	166	169	162.5	80.5
		4:30	82	162	155	154	160	171	166	166	169	162.8	80.8
		4:45	82	162	155	154	160	171	166	166	170	163.0	81.0

TABLE C

MRP-14

BEARING TEMPERATURES WHEN USING NO WASTE PACK

RUN NO. 1 - SINCO NO. 53 OIL. Present A.A.R. Specification EM-906-50

Observations / Time Mins.	TEMPERATURE, °F.										
	Amb.	Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Avgs.	Above Amb.
0	78	78	78	78	78	78	78	78	78	78	0
15	78	130	135	135	136	136	137	140	137	135.7	57.7
30	78	135	137	137	137	142	140	147	147	140.2	62.2
45	78	137	137	137	140	145	142	150	145	141.6	63.6
60	78	137	137	137	138	143	140	152	142	140.7	62.7
75	78	136	136	135	136	136	139	150	144	139.0	61.0
90	78	136	137	136	138	138	141	151	146	140.4	62.4

RUN NO. 2 - R.S.&S.C. RENOVATED OIL. Proposed Specification, 40-42 Viscosity

Observations / Time Mins.	TEMPERATURES, °F.										
	Amb.	Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Avgs.	Above Amb.
0	78	81	82	82	82	85	85	86	85	83.5	5.5
15	78	115	119	120	125	125	115	130	120	121.1	43.1
30	77	117	120	120	125	126	120	134	125	123.3	46.3
45	78	119	123	122	126	128	122	134	126	125.0	47.0
60	78	120	123	122	125	128	121	135	127	125.1	47.1
75	78	121	125	123	125	128	121	135	127	125.6	47.6
90	78	121	125	123	125	129	121	135	128	125.8	47.8

TABLE C

MRP-14

BEARING TEMPERATURES WHEN USING NO WASTE PACK

RUN NO. 1 - SINCO NO. 53 OIL. Present A.A.R. Specification EM-906-50

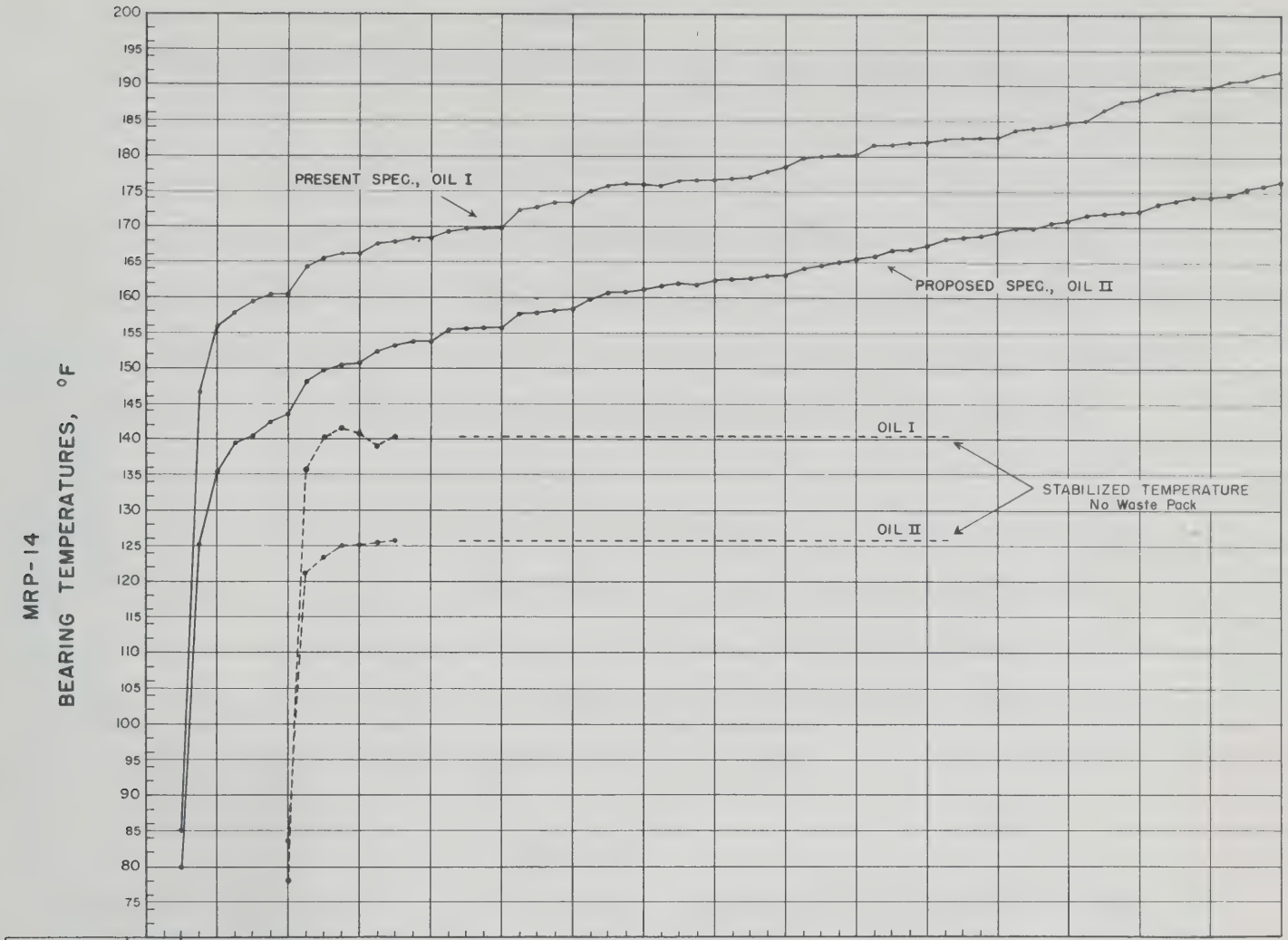
Observations / Time Mins.	TEMPERATURE, °F.										
	Amb.	Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Avgs.	Above Amb.
0	78	78	78	78	78	78	78	78	78	78	0
15	78	130	135	135	136	136	137	140	137	135.7	57.7
30	78	135	137	137	137	142	140	147	147	140.2	62.2
45	78	137	137	137	140	145	142	150	145	141.6	63.6
60	78	137	137	137	138	143	140	152	142	140.7	62.7
75	78	136	136	135	136	136	139	150	144	139.0	61.0
90	78	136	137	136	138	138	141	151	146	140.4	62.4

RUN NO. 2 - R.S.&S.C. RENOVATED OIL. Proposed Specification, 40-42 Viscosity

Observations / Time Mins.	TEMPERATURES, °F.										
	Amb.	Brg. 1	Brg. 2	Brg. 3	Brg. 4	Brg. 5	Brg. 6	Brg. 7	Brg. 8	Avgs.	Above Amb.
0	78	81	82	82	82	85	85	86	85	83.5	5.5
15	78	115	119	120	125	125	115	130	120	121.1	43.1
30	77	117	120	120	125	126	120	134	125	123.3	46.3
45	78	119	123	122	126	128	122	134	126	125.0	47.0
60	78	120	123	122	125	128	121	135	127	125.1	47.1
75	78	121	125	123	125	128	121	135	127	125.6	47.6
90	78	121	125	123	125	129	121	135	128	125.8	47.8

FIGURE NO. 1

TEMPERATURE - PRESSURE CURVE (MRP-14)



TIME	8:00 am	9:00	10:00	11:00	12:00	1:00 pm	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:0
WEIGHT, LBS.		3.5	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
WASTE-PACK PRESSURE, LBS		3.38	9.68	11.48	13 28	15.08	16.88	18.68	20.48	22.28	24.08	25.88	27.68	29.48	31.28	33.07	

Start of Test

WEIGHTS and PRESSURE APPLIED

PART IV

TEMPERATURE-FEED-VISCOSITY STUDY OF NEW CAR OIL (MRP-10)

OBJECT OF THE TEST

The object of the test was to determine bearing temperatures when using car oils of various viscosities (at 210°F.), both within, but more especially above and below the present oil viscosity range. It was concluded that the minimum viscosity oil available should be tested to determine its effect on bearing temperatures.

All but one of the car oils used for the test was furnished from one source, The Texas Company. This company cooperated by furnishing six samples of new car oils and an analysis of the principal properties. Two of these were mixed to produce a desired viscosity. One oil used was a new oil from laboratory samples on hand meeting AAR specification EM-906-50. The analysis of the pertinent properties of the oils used is shown by Table A of this Part.

PROCEDURE

The test was conducted on the half-scale 8-journal dynamic machine at the Central Research Laboratories. The established Waste-Oil procedure was followed. This procedure and machine have been so frequently described in former progress reports that they are not repeated herein.

Full data were recorded during each run, and the usual observations made in regard to the action of the packing, thread risers, rolling, feed, etc., but inasmuch as this test was primarily a study of final bearing temperatures, these data sheets are not included in this report. The packing action was characteristic and as expected, based on results of former published records of similar oils and waste. However, bearing temperatures and excess oil feed are shown graphically from data recorded during each test and these curves are attached as pages 41 to 48 inclusive.

DISCUSSION OF RESULTS

The resulting bearing temperatures and excess feed are shown graphically for the eight viscosities by Figure 1, page 49. Based on these curves, there is no evidence of any change in the trends of the data within the viscosity range investigated.

Although the feed was less at higher viscosities, there was ample lubrication and oil film at all times. The bearing temperatures were more a function of viscosity than feed, as would be expected from a consideration of the fact that less heat is developed in oil in viscous shear under a bearing when viscosity reduction reduces torque input required to rotate the journal.

Keeping in mind that the unit bearing loads of the 8 spindle machine are too small to represent the condition present in actual road service, it is doubtful if the lighter viscosity oils have sufficient film strength to provide proper lubrication under full loading. It is obvious that some compromise must be made in using an oil producing slightly higher bearing operating temperatures in order to obtain sufficient oil film thickness to avoid the boundary lubrication conditions that result in hot boxes.

TABLE A
MRP-10

PHYSICAL PROPERTIES OF THE OILS

(Oils listed from left to right in order of viscosity rating at 210°F)

SPECIFICATION ITEMS / OILS ANALYZED	TEXACO NO. 1576	TEXACO NO. 1600	TEXACO NO. 690	TEXACO NO. 663	TEXACO NO. 691	NEW CAR OIL AAR SPEC. EM-906-50	TEXACO - 50% NO. 691 - 50% NO. 694	TEXACO NO. 694
VISCOSITY								
SUS at 210° F	34.3	34.7	40.5	47.5	50.0	50.7	57.2	68.0
SUS at 100° F	58.7	61.78	118.2	297	327	287.6	499	762
VISCOSITY INDEX	53	81.6	85	32	57	88.2	57	63.5
POUR POINT	-10	-30	-40	-30	-30	-45	-10	-5
FLASH POINT	305	305	315	345	340	380	335	360

Analyses of the Texas Co. oils furnished by the supplier.

Analyses of the mixed oil and AAR Spec. EM-906-50 furnished by the Rock Island Railroad Laboratory, Chicago.

f9100-40

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

WASTE — OIL COMBINATION

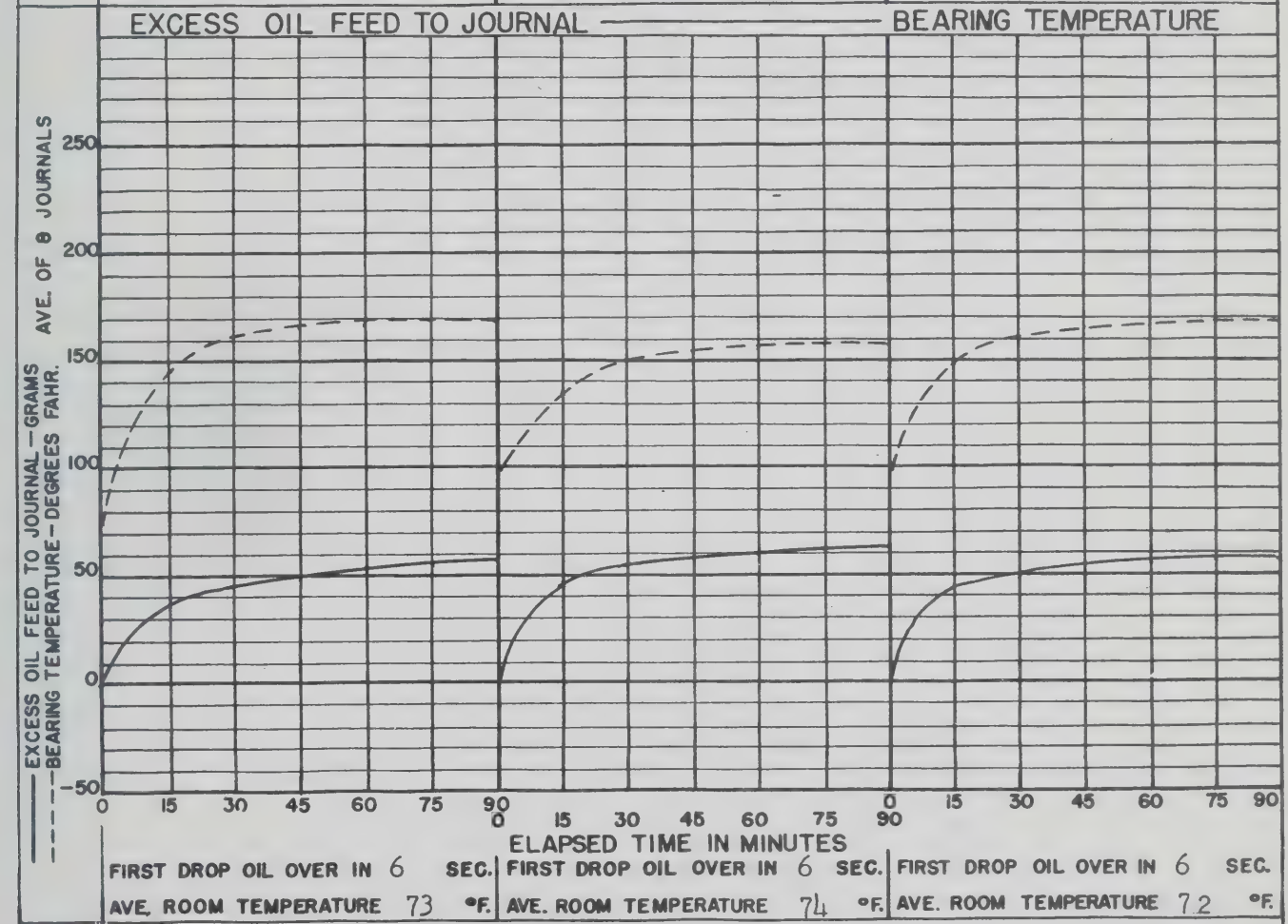
WASTE:- National All-Cotton

OIL:- The Texas Company TEXACO NO. 1576

RATIO OIL TO WASTE 3 1/2 TO 1.

WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



RUN NO. 1	RUN NO. 2	RUN NO. 3
FIRST DROP OIL OVER IN 6 SEC.	FIRST DROP OIL OVER IN 6 SEC.	FIRST DROP OIL OVER IN 6 SEC.
AVE. ROOM TEMPERATURE 73 °F.	AVE. ROOM TEMPERATURE 74 °F.	AVE. ROOM TEMPERATURE 72 °F.

REMARKS:-

SU VISCOSITY AT 210°F. - 34.3

SERIES- 201 TEST NO.- 193 DATE- 5-8-52 DATA SHEET NO. W-O- 193(CRL)

f9100-42

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

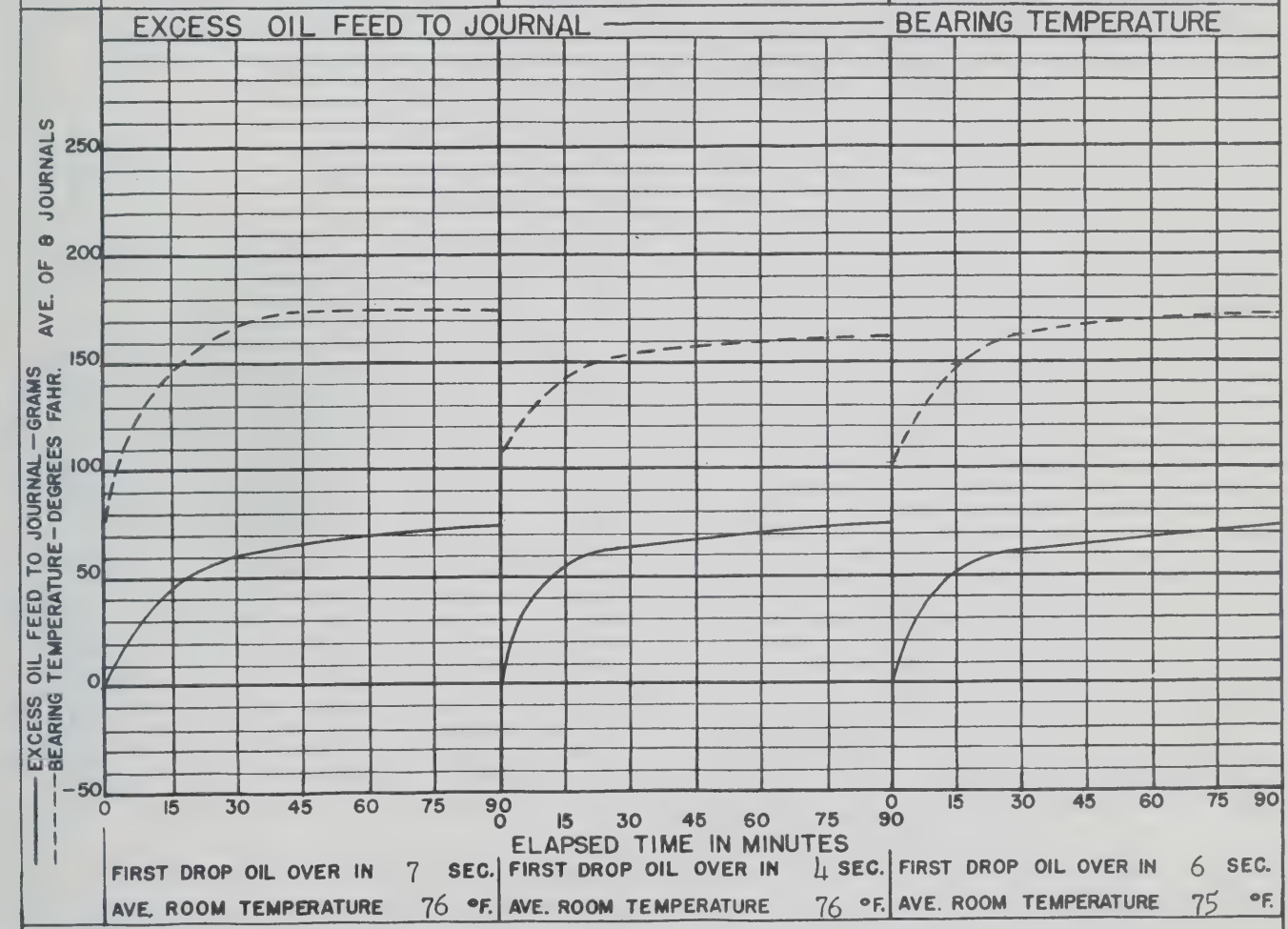
WASTE — OIL COMBINATION

WASTE:- National All-Cotton

OIL:- The Texas Company
TEXACO NO. 1600

RATIO OIL TO WASTE 3 1/2 TO 1.
WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



	RUN NO. 1	RUN NO. 2	RUN NO. 3
FIRST DROP OIL OVER IN	7 SEC.	4 SEC.	6 SEC.
AVE. ROOM TEMPERATURE	76 °F.	76 °F.	75 °F.

REMARKS:- SU VISCOSITY AT 210°F. - 34.7

SERIES- 201 TEST NO.- 197 DATE- 5-15-52 DATA SHEET NO. W-O-197 (CRL)

ASSOCIATION OF AMERICAN RAILROADS CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS 50-POUND JOURNAL LOAD SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

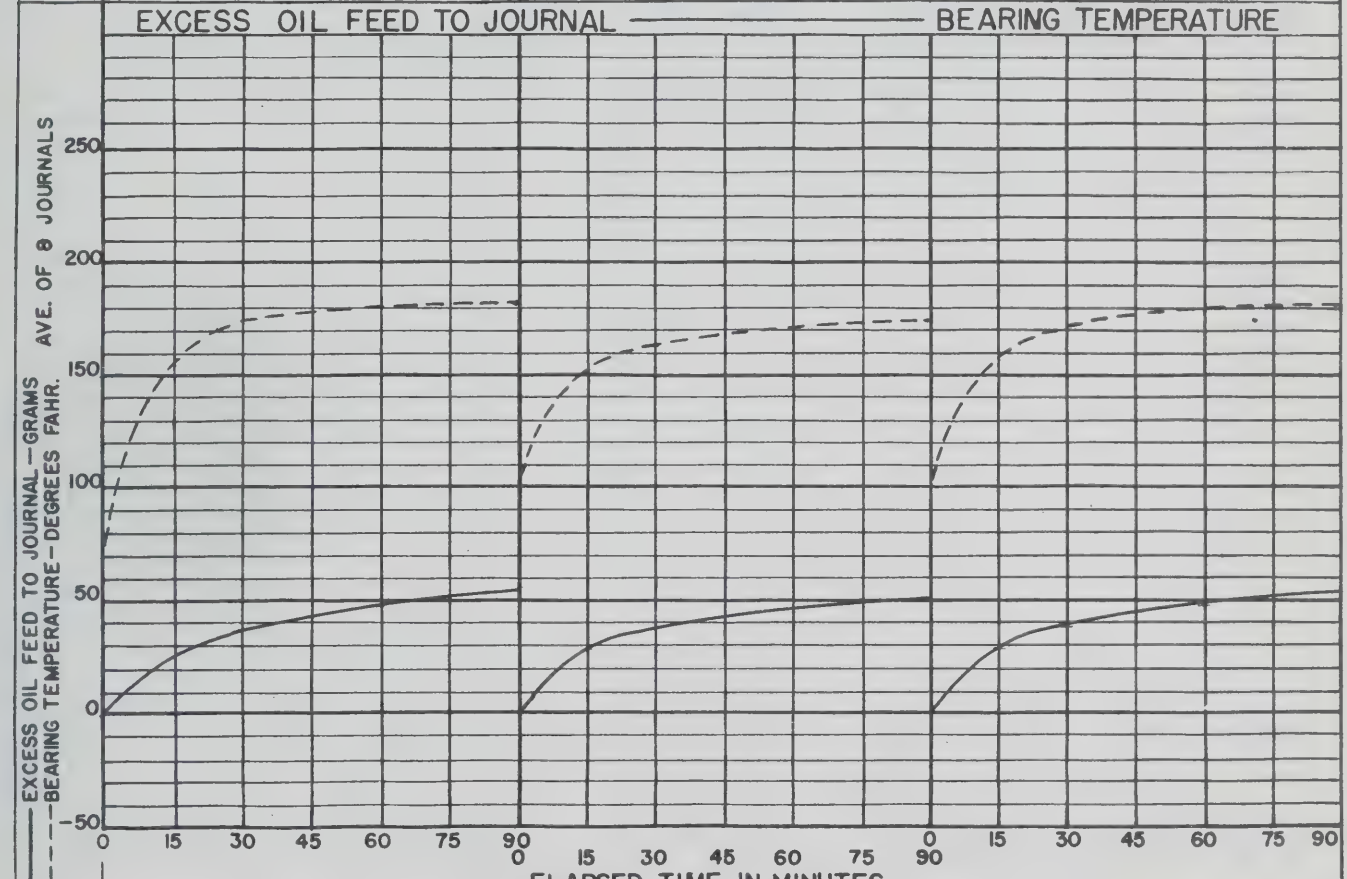
WASTE—OIL COMBINATION

WASTE:- National All-Cotton

OIL:- The Texas Company
TEXACO NO. 690

RATIO OIL TO WASTE 3 1/2 TO 1.
WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



FIRST DROP OIL OVER IN	14 SEC.	FIRST DROP OIL OVER IN	7 SEC.	FIRST DROP OIL OVER IN	14 SEC.
AVE. ROOM TEMPERATURE	74 °F.	AVE. ROOM TEMPERATURE	75 °F.	AVE. ROOM TEMPERATURE	75 °F.

REMARKS:- SU VISCOSITY AT 210°F. - 40.5

SERIES- 201 TEST NO.- 194 DATE- 5-9-52 DATA SHEET NO. W-O- 194(CRL)

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

WASTE — OIL COMBINATION

WASTE:- National All-Cotton

OIL:- The Texas Company
TEXACO NO. 663

RATIO OIL TO WASTE 3 1/2 TO 1.
WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO.1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.

FIRST DROP OIL OVER IN 60 SEC.	FIRST DROP OIL OVER IN 27 SEC.	FIRST DROP OIL OVER IN 35 SEC.
AVE. ROOM TEMPERATURE 75°F.	AVE. ROOM TEMPERATURE 77°F.	AVE. ROOM TEMPERATURE 80 °F.

REMARKS:-

SU VISCOSITY AT 210°F. - 47.5

SERIES-201 TEST NO.- 195 DATE- 5-13-52 DATA SHEET NO. W-O-195 (CRL)

f 9100-45

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

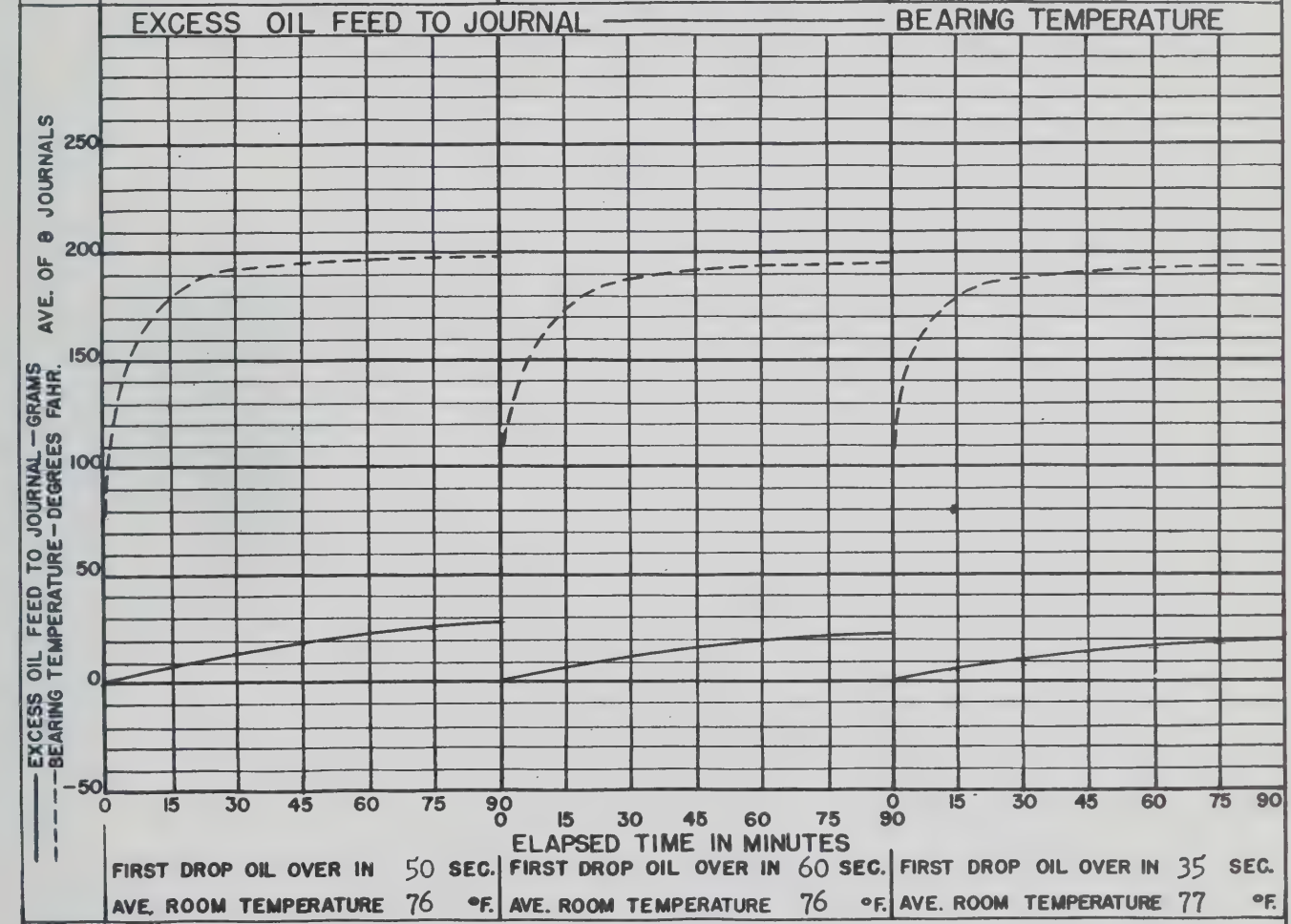
WASTE — OIL COMBINATION

WASTE:- National All-Cotton

OIL:- The Texas Company
TEXACO NO. 691

RATIO OIL TO WASTE 3 1/2 TO 1.
WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



RUN NO. 1	RUN NO. 2	RUN NO. 3
FIRST DROP OIL OVER IN 50 SEC.	FIRST DROP OIL OVER IN 60 SEC.	FIRST DROP OIL OVER IN 35 SEC.
AVE. ROOM TEMPERATURE 76 °F.	AVE. ROOM TEMPERATURE 76 °F.	AVE. ROOM TEMPERATURE 77 °F.

REMARKS:-

SU VISCOSITY AT 210°F. - 50.0

SERIES- 201 TEST NO.- 196 DATE- 5-14-52 DATA SHEET NO. W-O-196 (CRL)

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

WASTE — OIL COMBINATION

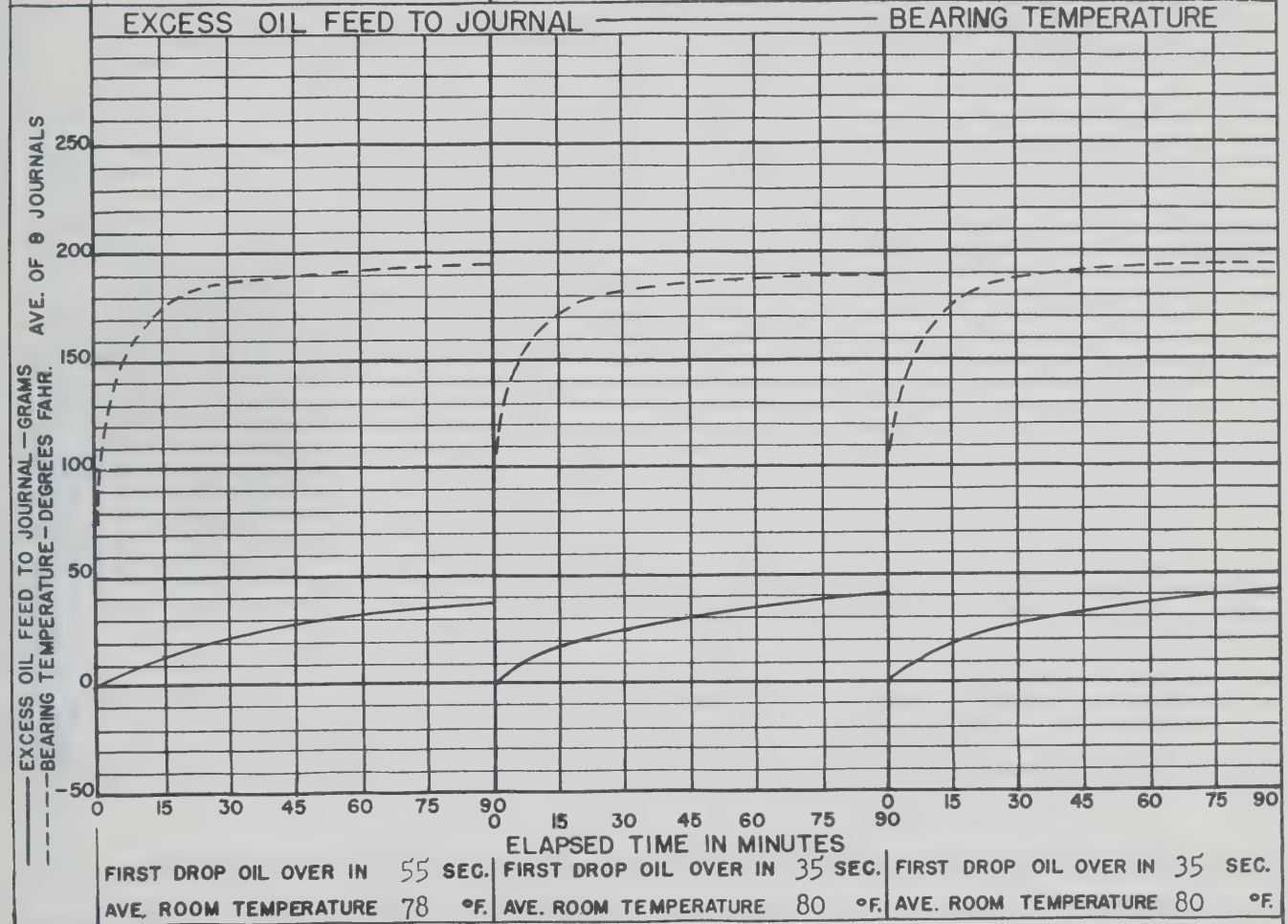
WASTE:- National All-Cotton

OIL:- AAR Spec. EM-906-50

RATIO OIL TO WASTE 3 1/2 TO 1.

WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



	RUN NO. 1	RUN NO. 2	RUN NO. 3
FIRST DROP OIL OVER IN	55 SEC.	35 SEC.	35 SEC.
AVE. ROOM TEMPERATURE	78 °F.	80 °F.	80 °F.

REMARKS:-

SU VISCOSITY AT 210°F. - 50.7

SERIES- 201 TEST NO.- 199 DATE- 5-20-52 DATA SHEET NO. W-O-199 (CRL)

f9100-47

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL-PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

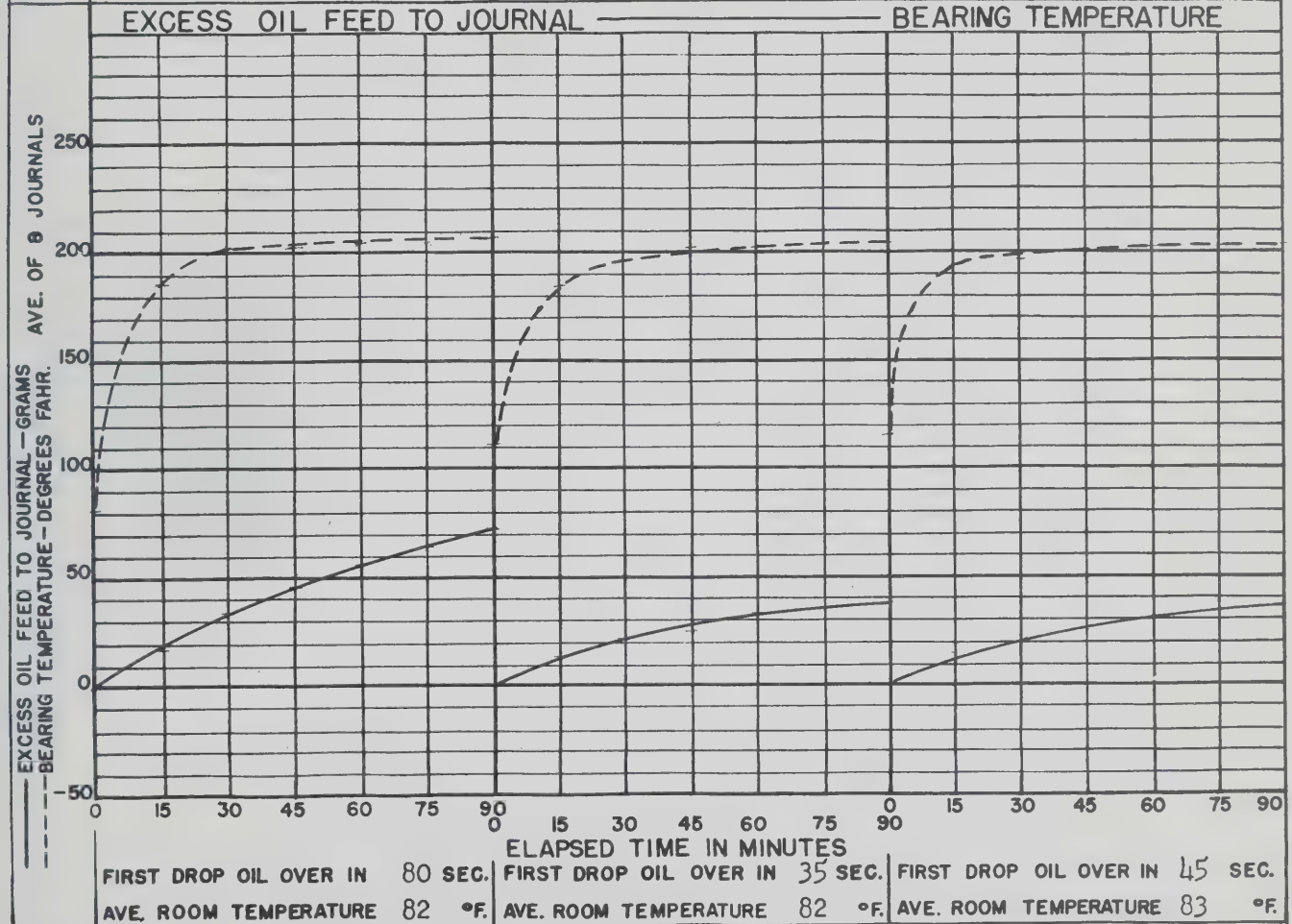
WASTE — OIL COMBINATION

WASTE:- National All-Cotton

OIL:- The Texas Company
TEXACO NO. 691 - 50%
TEXACO NO. 694 - 50%

RATIO OIL TO WASTE 3 1/2 TO 1.
WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



FIRST DROP OIL OVER IN 80 SEC.	FIRST DROP OIL OVER IN 35 SEC.	FIRST DROP OIL OVER IN 45 SEC.
AVE. ROOM TEMPERATURE 82 °F.	AVE. ROOM TEMPERATURE 82 °F.	AVE. ROOM TEMPERATURE 83 °F.

REMARKS:-

SU VISCOSITY AT 210°F. - 57.2

SERIES- 201 TEST NO.- 200 DATE- 6-20-52 DATA SHEET NO. W-O-200 (CRL)

f9100-48

ASSOCIATION OF AMERICAN RAILROADS — CENTRAL RESEARCH LABORATORY

JOURNAL BOX WASTE THREAD-OIL PACKING RESEARCH PROGRAM

SCREENING TEST SCHEDULE — SPECIAL 8-JOURNAL MACHINE

$2\frac{3}{4}$ X 5-INCH JOURNALS — 50-POUND JOURNAL LOAD — SPEED 934 R.P.M.

UNIFORM DIRECTION OF ROTATION AND SPEED

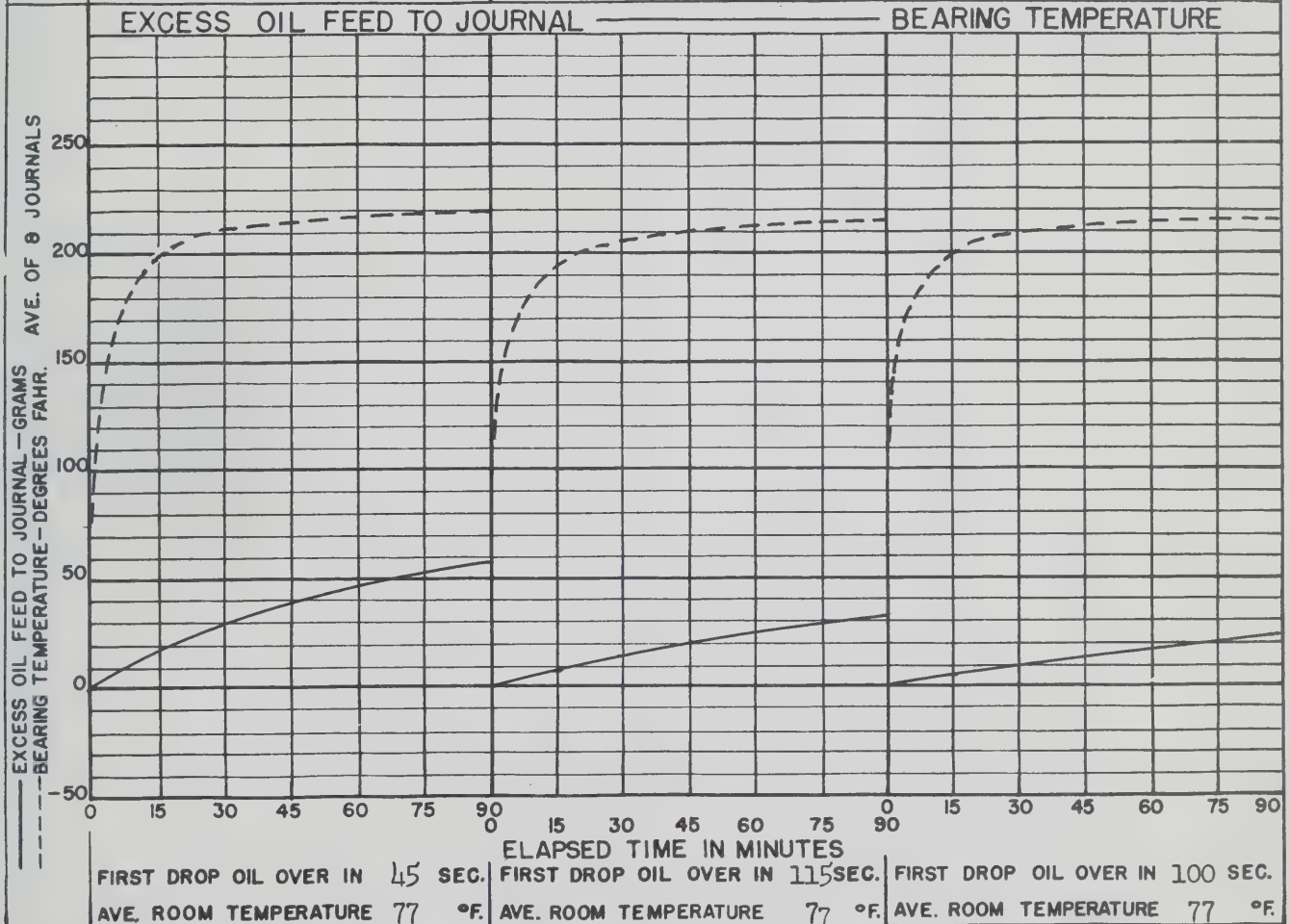
WASTE — OIL COMBINATION

WASTE:- National All-Cotton

OIL:- The Texas Company
TEXACO NO. 694

RATIO OIL TO WASTE 3 1/2 TO 1.
WEIGHT OF SATURATED PACKING 563 GRAMS

CONDITIONS OF TEST	RUN NO. 1	RUN NO. 2	RUN NO. 3
	OVERNIGHT STANDING 16 HOURS ALL CELLARS PACKED TO FIXED VOLUME SIMULATING SERVICE CONDITIONS	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 1. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS MOVABLE UNDER UNIFORM WEIGHT LOAD.	AFTER REPLACING OIL COLLECTED FROM JOURNALS ON RUN NO. 2. QUIESCENT FOR 75 MIN. PACKINGS UNDISTURBED. ALL CELLARS RETURNED TO FIXED VOLUME POSITIONS.



FIRST DROP OIL OVER IN 45 SEC.	FIRST DROP OIL OVER IN 115 SEC.	FIRST DROP OIL OVER IN 100 SEC.
AVE. ROOM TEMPERATURE 77 °F.	AVE. ROOM TEMPERATURE 77 °F.	AVE. ROOM TEMPERATURE 77 °F.

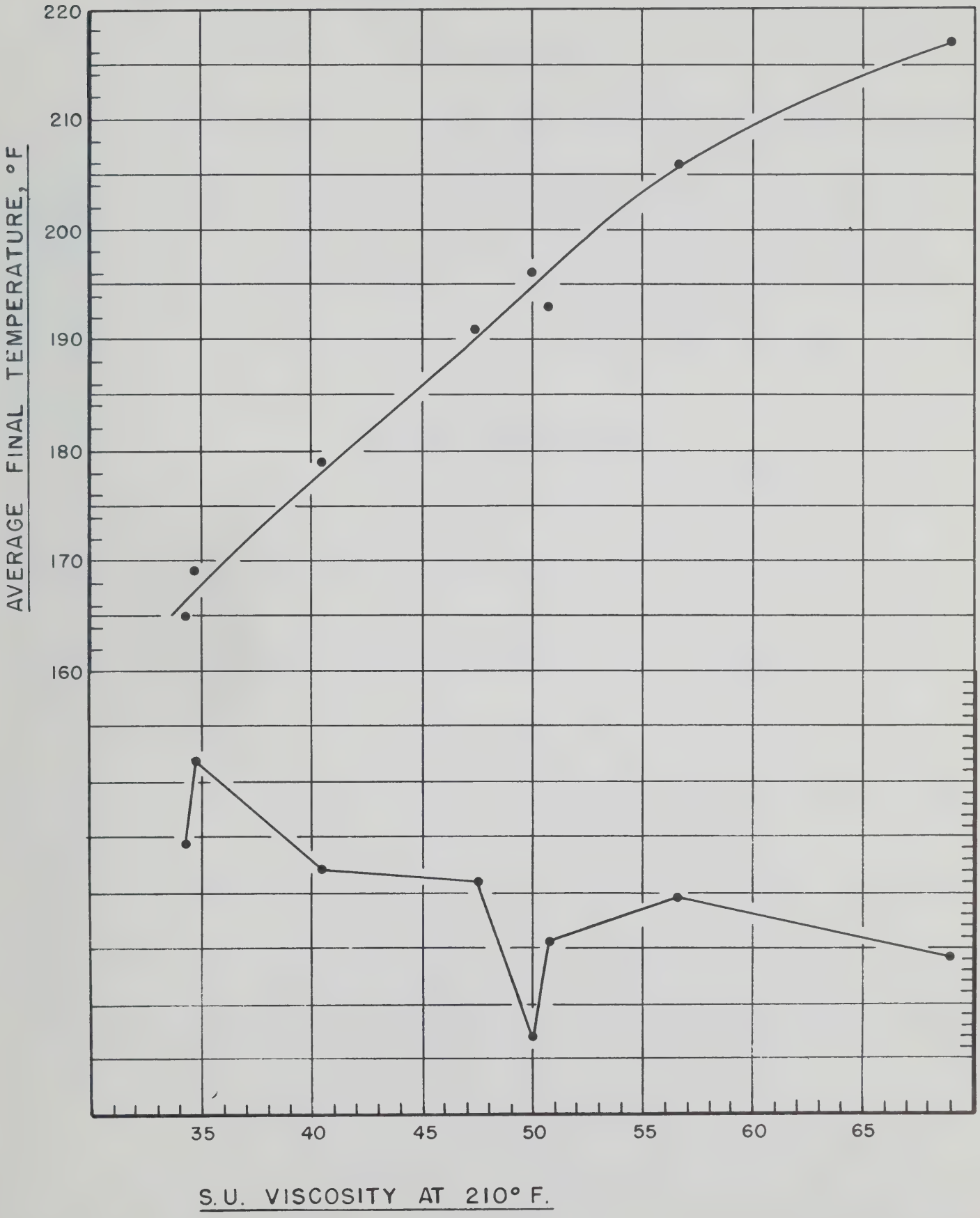
REMARKS:-

SU VISCOSITY AT 210°F. - 68.0

SERIES- 201 TEST NO.- 198 DATE- 5-16-52 DATA SHEET NO. W-O- 198 (CRL

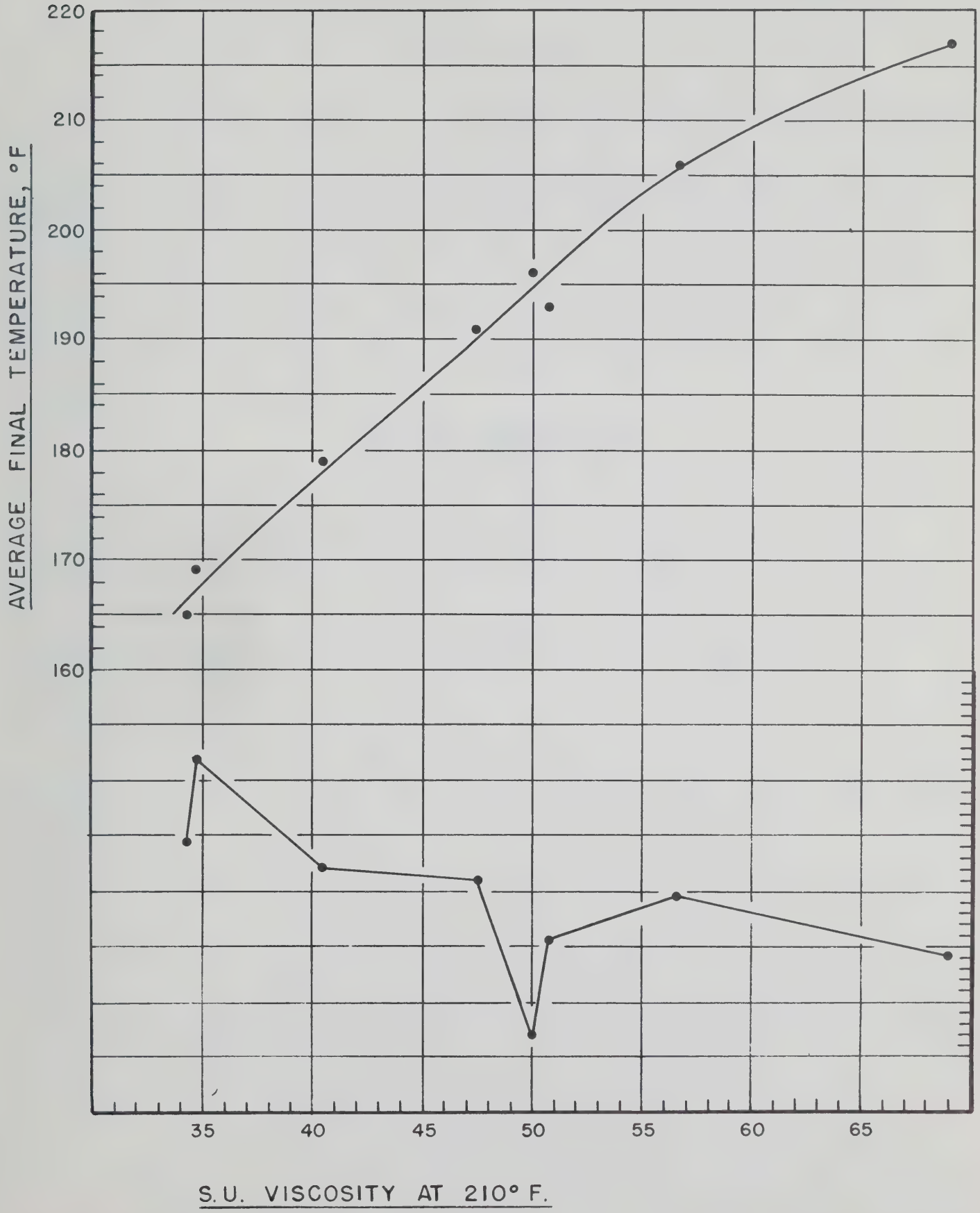
W-O TESTS, VISCOSITY – TEMPERATURE – FEED

FIGURE – 1



W-O TESTS, VISCOSITY-TEMPERATURE-FEED

FIGURE - 1



PART V

LABORATORY STUDY OF THE INERTIA AND ROLLING OF JOURNAL BOX PACKING AS AFFECTED BY A PACKING RETAINING RIB IN BOTTOM OF JOURNAL BOX (MRP-7.9)

OBJECT OF THE TEST

The object of the test was to determine if the inertia of the journal packing contributes materially to packing displacement during coupling impacts, and if a packing retaining rib in the bottom of the box would be effective in keeping the packing in proper position; also, to determine if the rib will prevent rolling of packing in cold temperatures. The purpose of locating the rib at the bottom of the box was to anchor the packing before it started to move rather than attempt to stop it after a displacement had begun.

PROCEDURE - INERTIA TESTS

The inertia tests were conducted on the Con-Bur impact machine located at the Central Research Laboratories. This is a machine developed by the A.A.R. Container Bureau, and consists of a small platform on wheels which is released to move down an inclined track to a solid bumping post. The height of the release is controlled, and the impact calculated in miles per hour. A photograph of the machine is shown on page 54.

A standard 5½" x 10" pedestal type journal box was mounted solidly in level position on the travelling platform. A 5½" x 10" dummy journal was solidly secured in normal position within the box. The waste pack consisted of new waste and new oil of A.A.R. Specification EM-906-50, viscosity at 210°F. of 50.7 SUS. The pack was saturated in accordance with the standard practice, with a ratio of 3½ parts oil to 1 of waste. The packing weighed 9 lbs., and was applied in the box in accordance with Figure 1 in the Lubrication Manual. The photograph on page 54 shows the test equipment used.

Following is a table showing calculated velocity of travel at impact reduced to miles per hour, disregarding some slight mechanical friction:

Travel in Feet	-	Miles per Hour
1	-	2.28
2	-	3.22
3	-	3.94
4	-	4.56
5	-	5.09
6	-	5.57
7	-	6.01
8	-	6.43
9	-	6.83
10	-	7.19
11(Maximum)	-	7.54

FORMULA

$v = 2 g S \sin \theta$

v = Velocity of impact
g = Gravity acceleration
S = Feet traversed
θ = Angle of incline -10°

After the box was packed and photographed, 11 impacts were made, starting at one foot and increasing to the 11-foot maximum in one foot increments. Photographs and observations were made after each impact. A twelfth impact was made afterward, with the packing again reset to the journal and one quart of oil added. Identical series of impacts were made with and without the rib in the bottom of the box.

The first series of impacts was made without the box rib. Photographs showing the packing condition before the impacts and after 11 and 12 impacts are shown on pages 55 and 56. The angle of the photographs gives the appearance of overpacked boxes, but actually the packing was originally 1" below center line of journal. The small bracket which is visible at the end of the journal was a device to strengthen the structure and played no part in holding the packing in position. Although oil was thrown out of the open box at every impact, there was no perceptible displacement of packing until the 3-foot impact at 3.94 mph. Further displacement occurred after each subsequent impact, but was gradual. Displacement due to impact was more pronounced with the soggier waste.

The second series of impacts was made with the rib in the bottom of the box, and a typical installation is shown in photograph on page 57. The rib used in the

impact tests extended 3/4" above the bottom of the box, was 7-7/8" long, and was applied centrally parallel to the journal axis. The results of impact are shown in photographs on pages 56 and 57. Displacement toward and under the end collar was not as pronounced when using the rib.

PROCEDURE - COLD DISPLACEMENT TESTS

Using identical waste packs employed in the impact tests, cold displacement tests were conducted on the full size Journal Pilot Machine at the Central Research Laboratories. This machine is illustrated in Part II, Section 1, of this Progress Report. Cold breakaway tests were made with and without journal box ribs, and using two different sizes of ribs: 3/4" x 7-7/8" as used during impact tests, and 1-1/4" x 7-7/8".

Prior to each breakaway test, an orientation run was made on the day previous. This orientation serves to adjust the waste to running position, eliminate thread risers, and develop running temperature at normal laboratory room temperature. After orientation, the entire assembly was "frozen down" overnight, which resulted in an ambient temperature of approximately 18 degrees below zero for a considerable period prior to the breakaways the next morning.

Observations during the breakaways with and without the 3/4" rib are shown by photographs on pages 58 and 59.

Later, cold breakaway tests were conducted in the same manner with and without the 1-1/4" rib. Photographs are not available to illustrate these tests, but one breakaway was made when employing the rib, and two without the rib. The observations during these tests indicate a slight displacement when employing this rib, as compared to two extreme displacements without it.

DISCUSSION OF RESULTS

These laboratory tests did not simulate all of the conditions encountered in road service, but they are informative to the extent that:

INERTIA

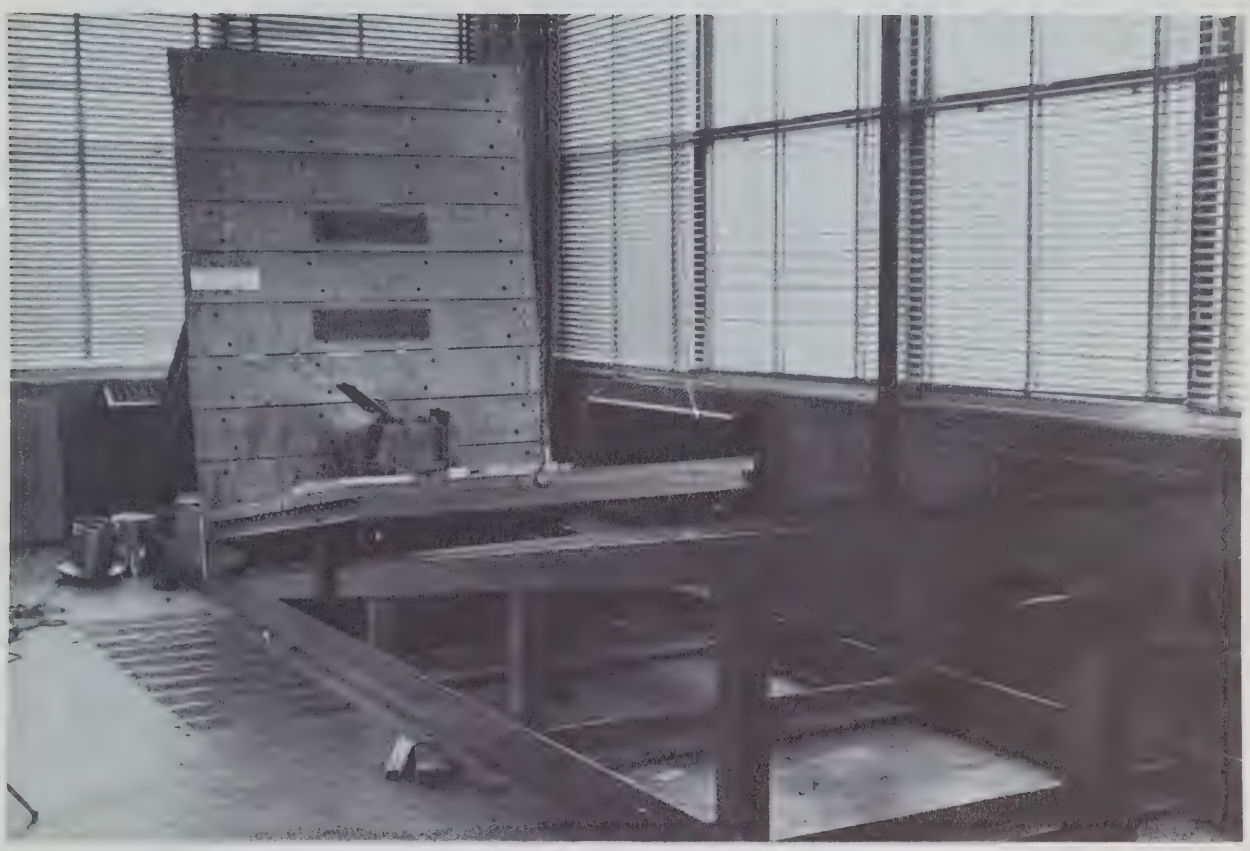
1. Inertia of properly saturated packing is not in itself the major cause of packing displacement.
2. The use of the 3/4" rib in the journal box tended to reduce displacement due to inertia.

COLD DISPLACEMENT

1. The use of a 3/4" rib in the bottom of the journal box will not completely eliminate packing displacement. The rolling starts at the journal surface, and the packing is rolled and pulled over the rib to the rising side of the journal.
2. The use of the 1-1/4" rib in the box showed more definite benefit to prevent rolling of packing.

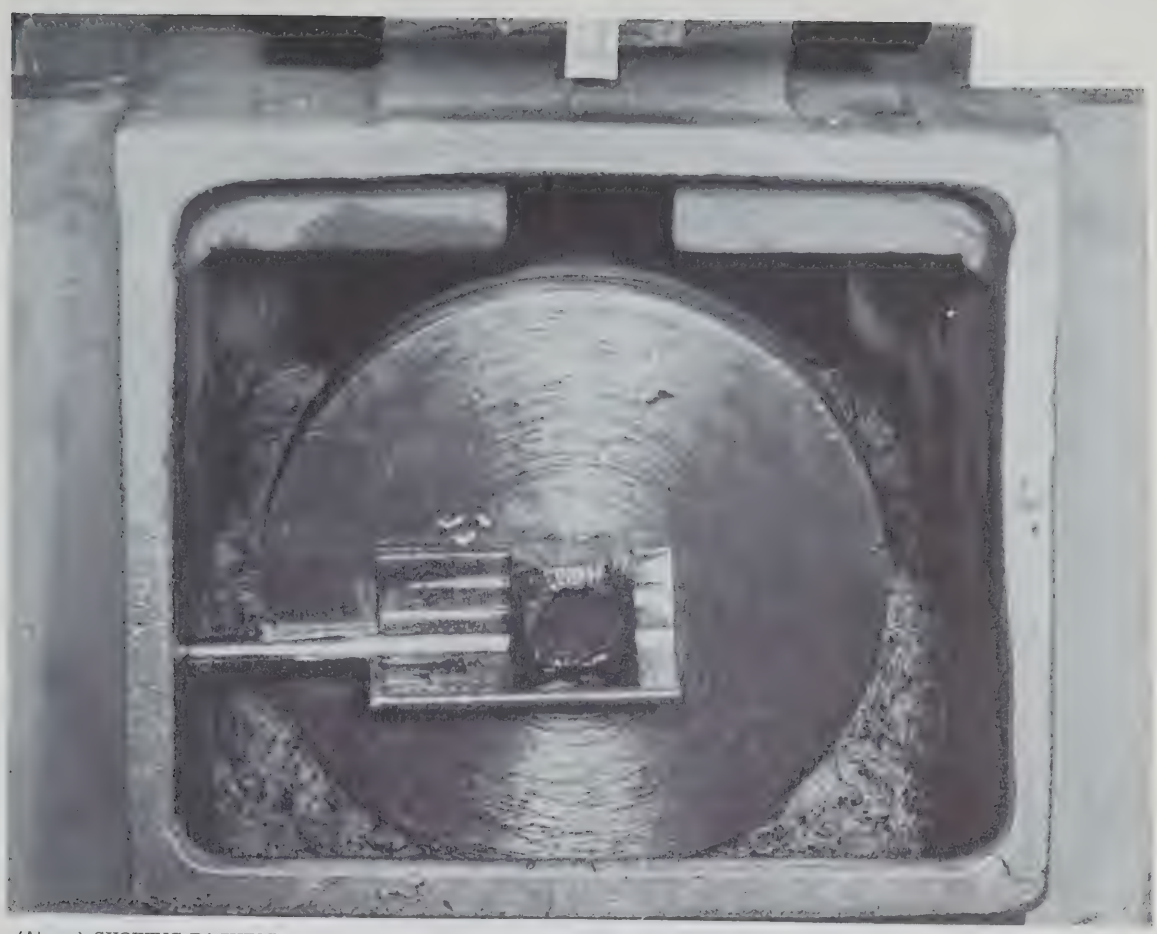
It requires several days to conduct a series of comparative breakaway tests. Even when employing the same procedure and materials and careful control, results are often not duplicated. Undetermined variables such as the human element in box packing apparently affect the amount of displacement. The length of time since repack probably has considerable effect on packing displacements, as the packing becomes more of a unit mass as it packs together in the service vibration. The photographs of displacements illustrate this result.

Either rib, as employed in the laboratory, increased slightly the difficulty of packing the box, but this objection was not serious.



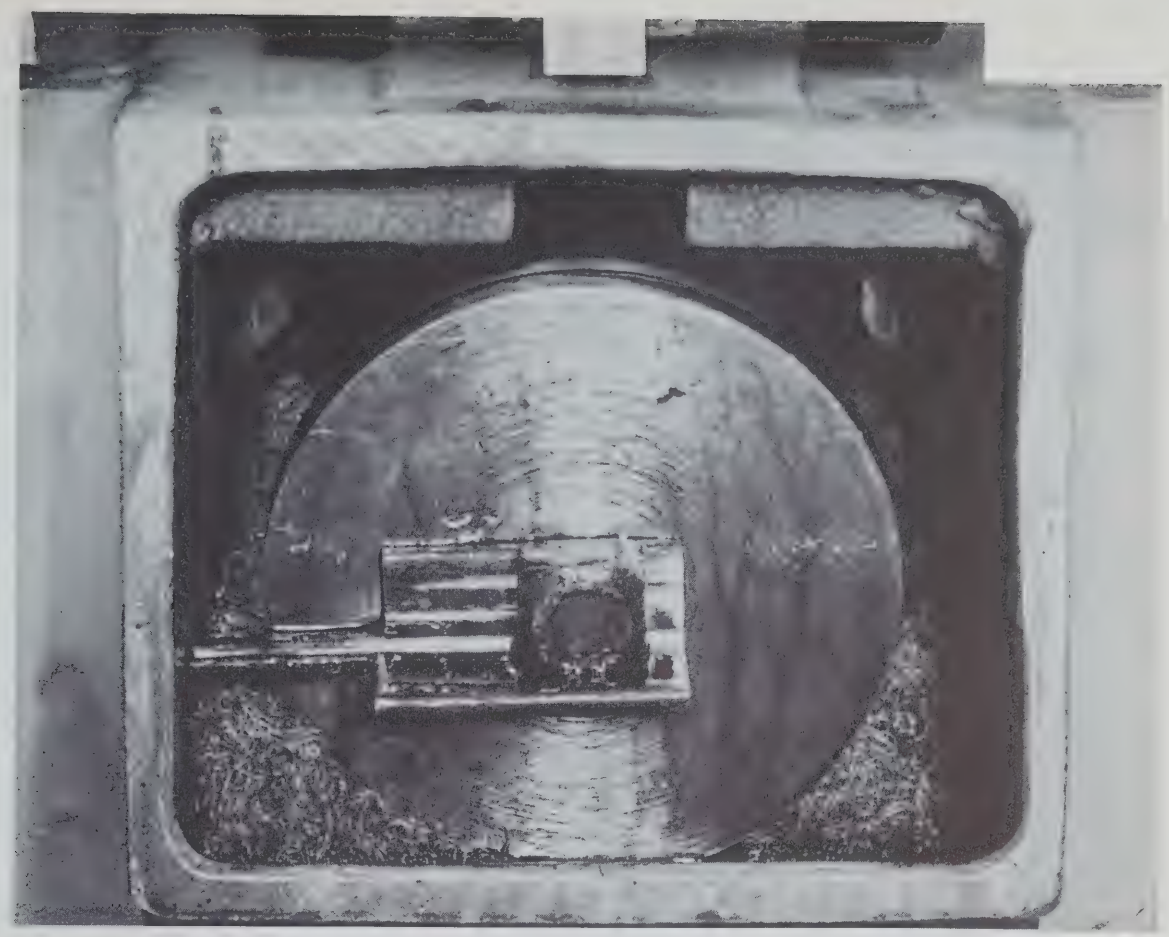
(Above) THE CON-BUR IMPACT MACHINE LOCATED AT THE CENTRAL RESEARCH LABORATORIES IN CHICAGO.

(Below) THE JOURNAL BOX MOUNTED ON TRAVELING PLATFORM WHICH IS AGAINST THE BUMPING POST. NOTE OIL MARKS BECAUSE IMPACTS WERE MADE WITH BOX LID OPEN.



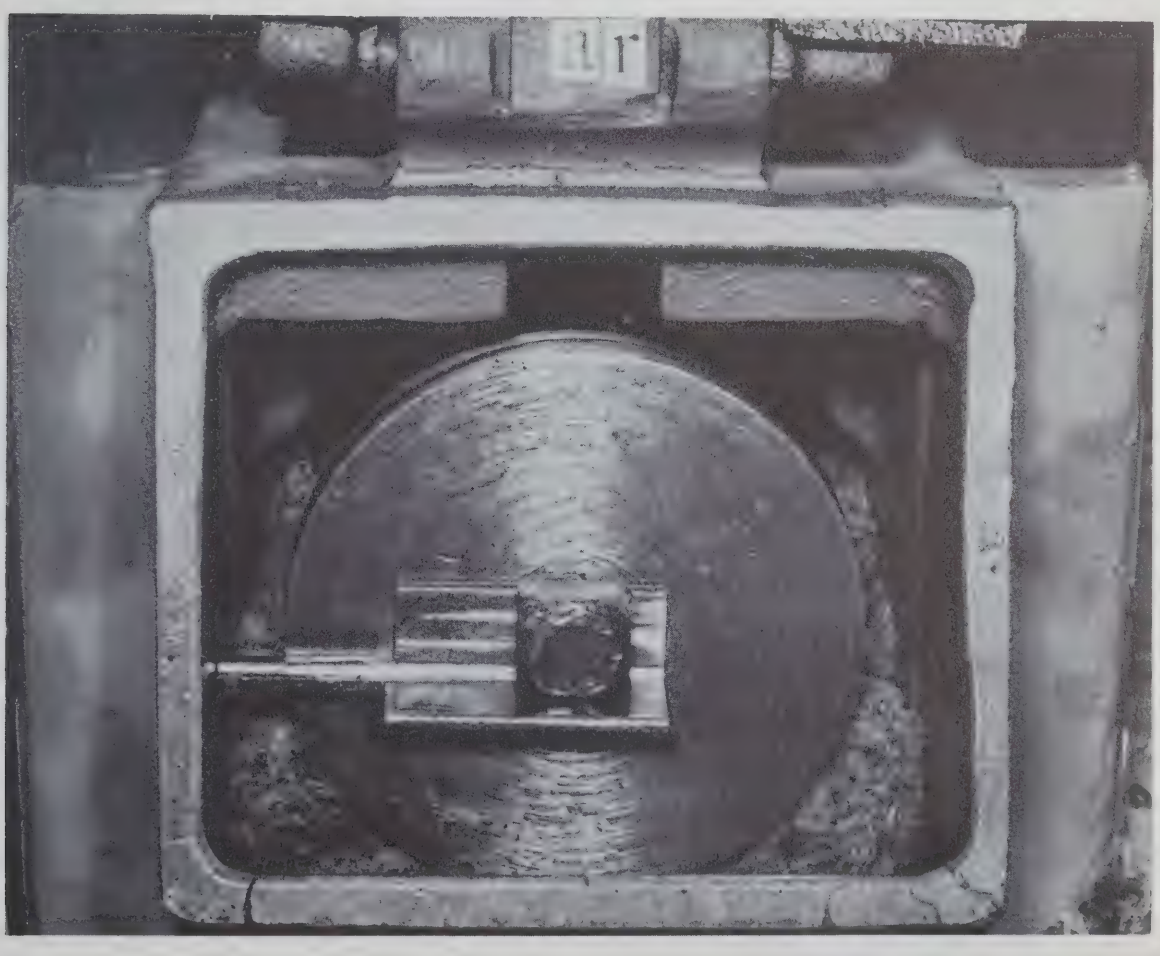
(Above) SHOWING PACKING BEFORE IMPACT AND WITHOUT THE RIB IN BOTTOM OF BOX. ANGLE OF PHOTOGRAPH CAUSES PACKING TO APPEAR ABOVE CENTER LINE OF JOURNAL, BUT ACTUALLY IT WAS 1" BELOW CENTER LINE. IMPACT IN ALL PHOTOGRAPHS IS TOWARD LEFT.

(Below) AFTER 11 IMPACTS WITHOUT BOX RIB. THE MOST NOTICEABLE DISPLACEMENT WAS TOWARD VIEWER, UNDERNEATH THE JOURNAL END-COLLAR.



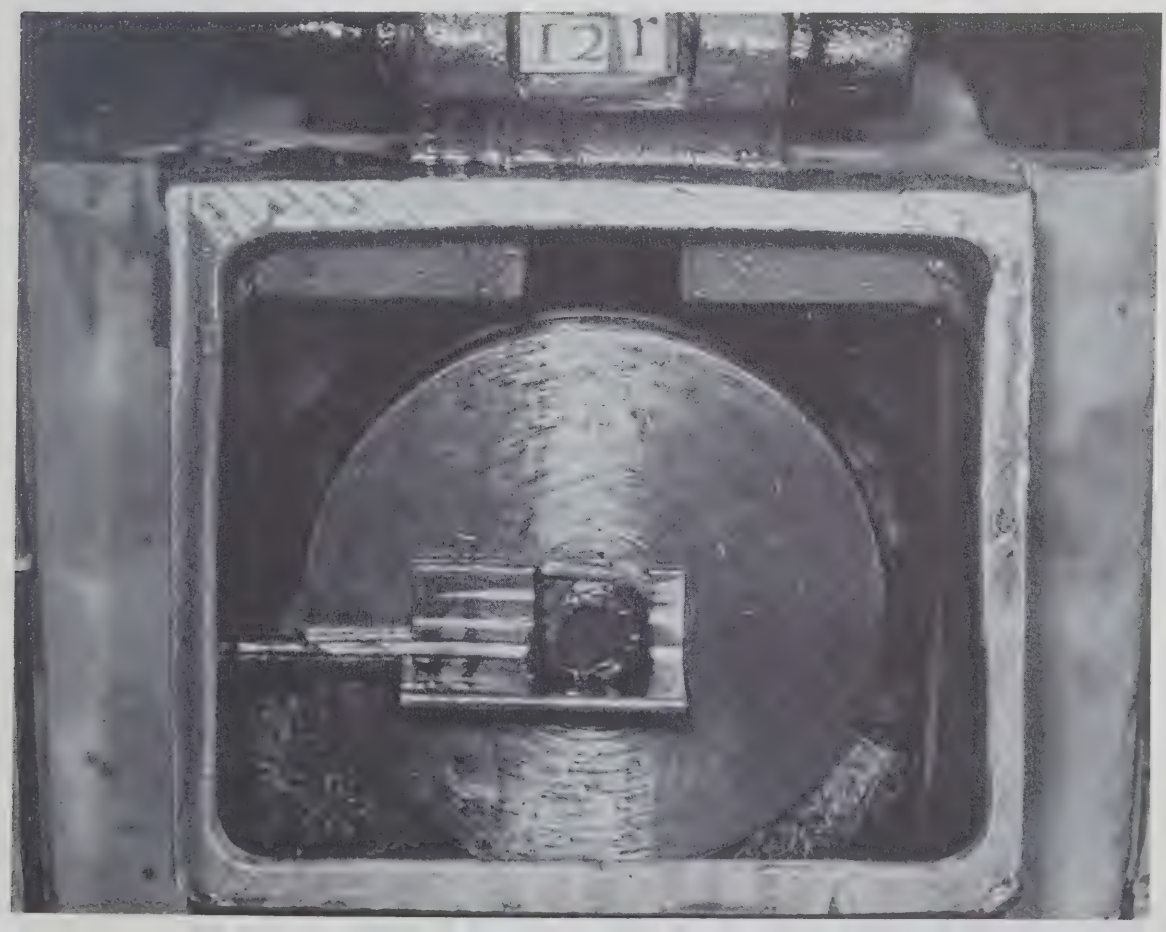
(Above) AFTER ONE 11-FOOT IMPACT WITH SOGGIER WASTE CAUSED BY ADDITION OF ONE QUART OF OIL WITH PACKING RE-SET. THE EFFECT OF INERTIA WAS GREATER WITH THE SOGGIER WASTE.

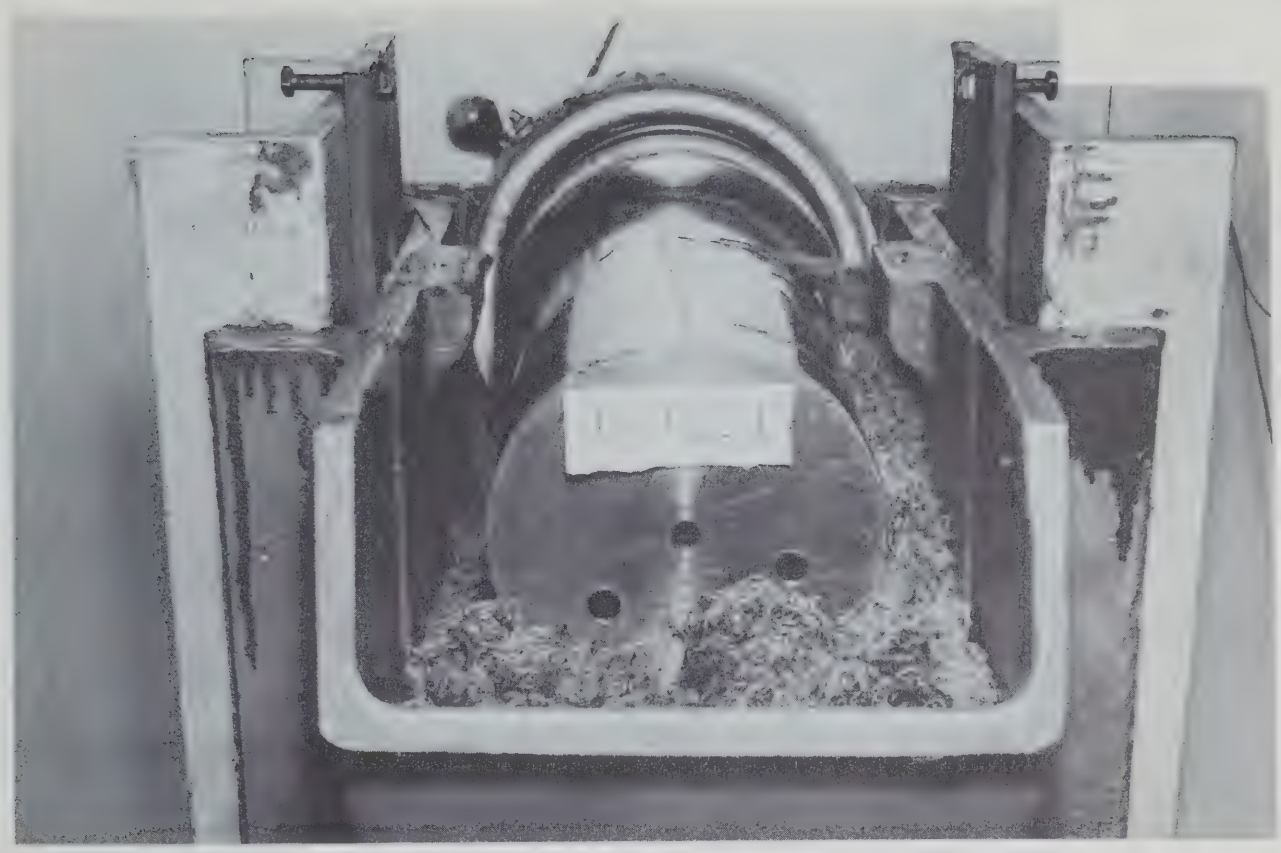
(Below) SHOWING THE PACKING BEFORE IMPACT, WITH 3/4" RIB IN BOTTOM OF BOX.



(Above) AFTER 11 IMPACTS WITH BOX RIB. DISPLACEMENT ENDWISE UNDER THE COLLAR WAS NOT SO PRONOUNCED WHEN USING RIB.

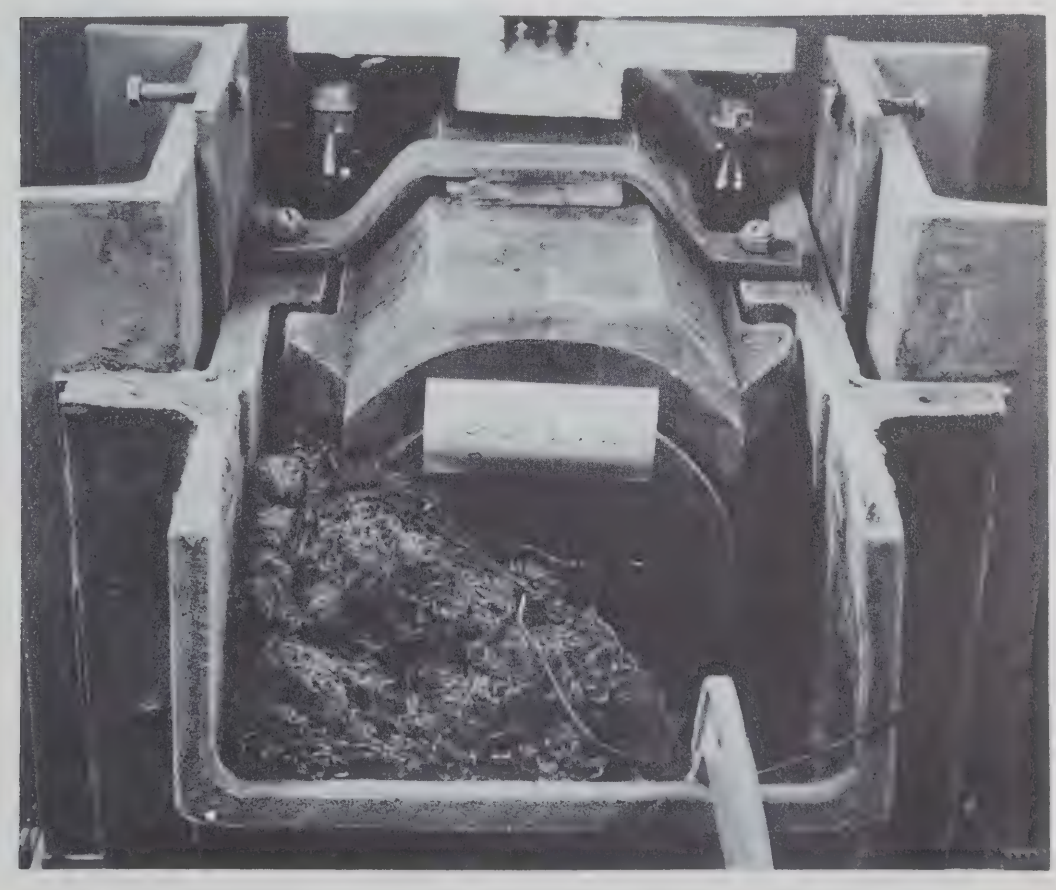
(Below) AFTER 11-FOOT IMPACT WITH THE SOGGIER WASTE, USING RIB.

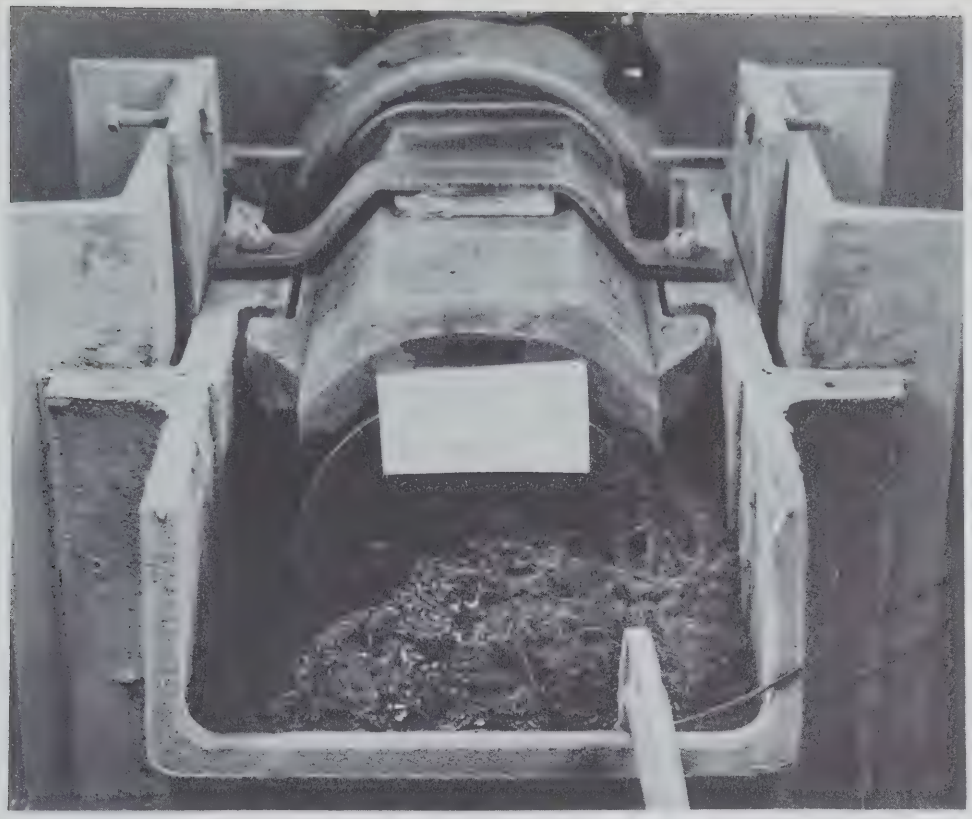




(Above) COLD DISPLACEMENT NO. 1 WHEN USING 3/4" RIB.

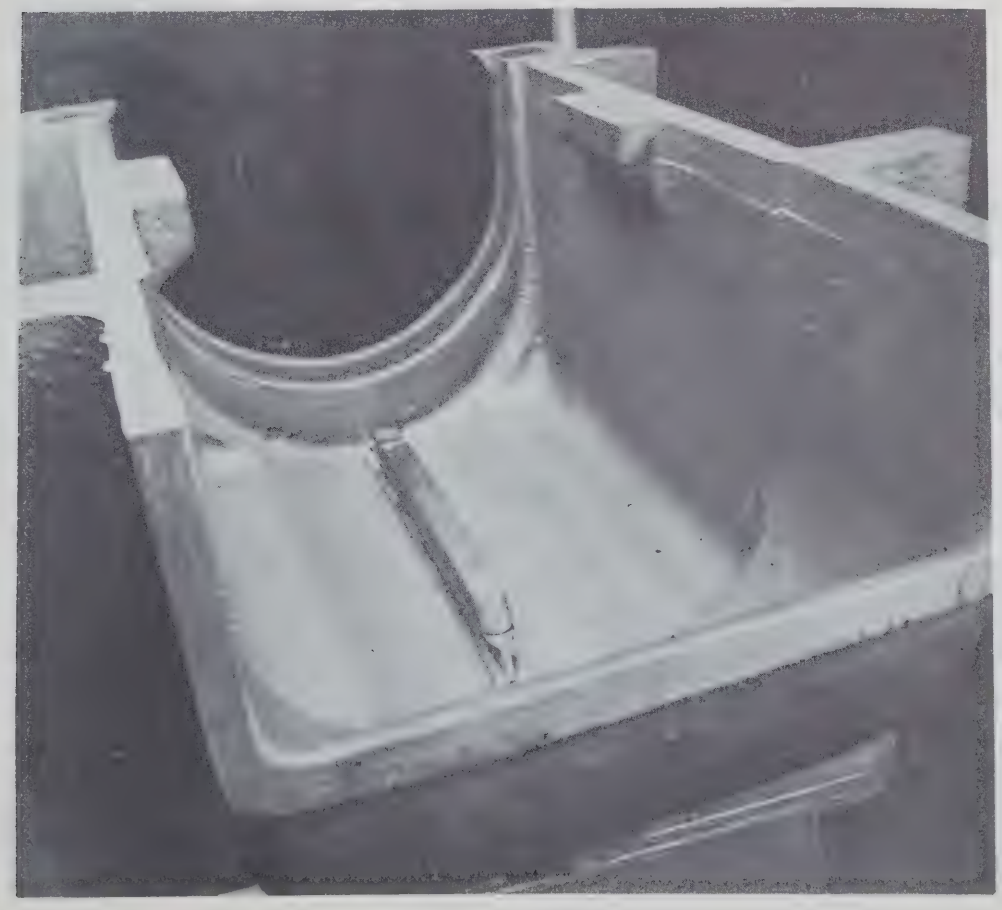
(Below) COLD DISPLACEMENT NO. 2 WITHOUT RIB.

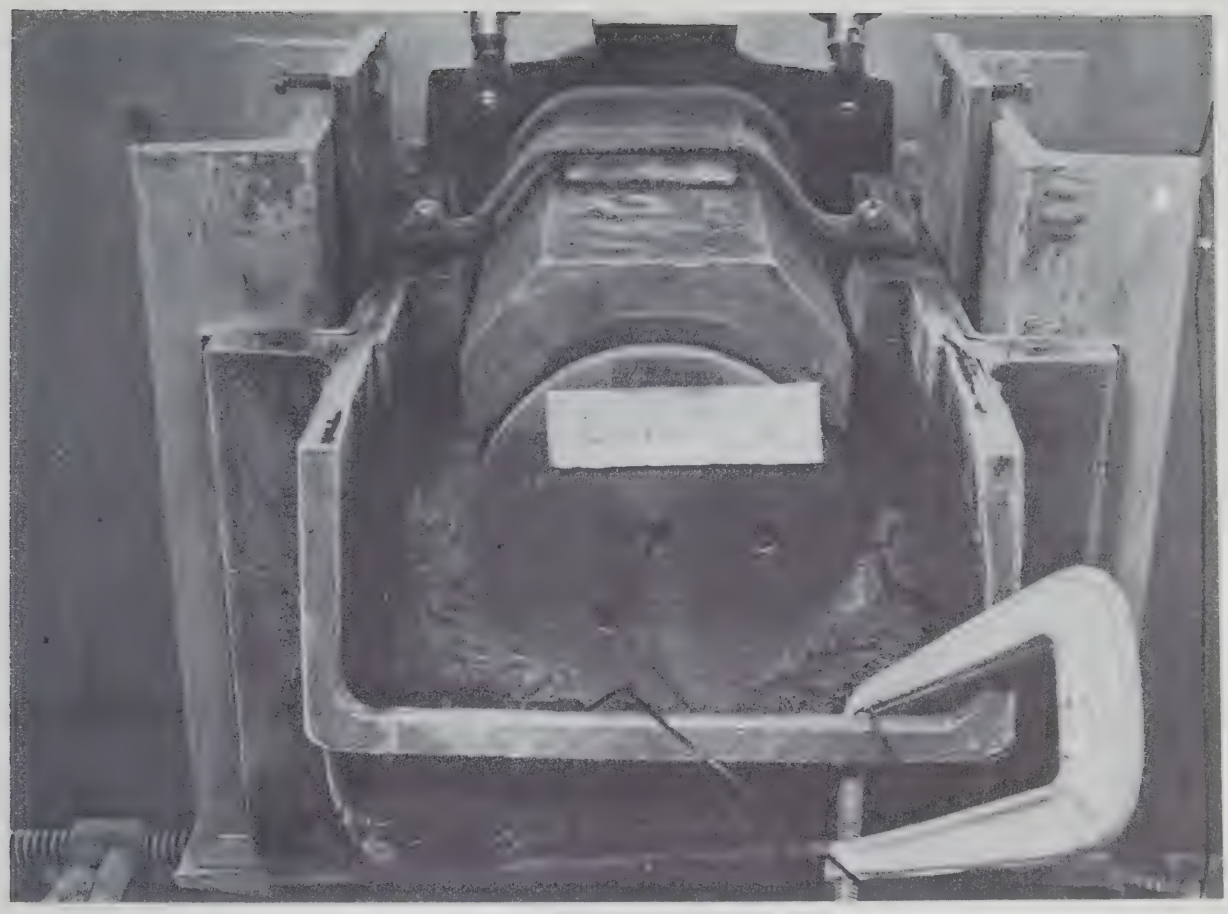




(Above) COLD DISPLACEMENT NO. 2 AFTER REVERSING DIRECTION OF ROTATION, USING NO RIB.

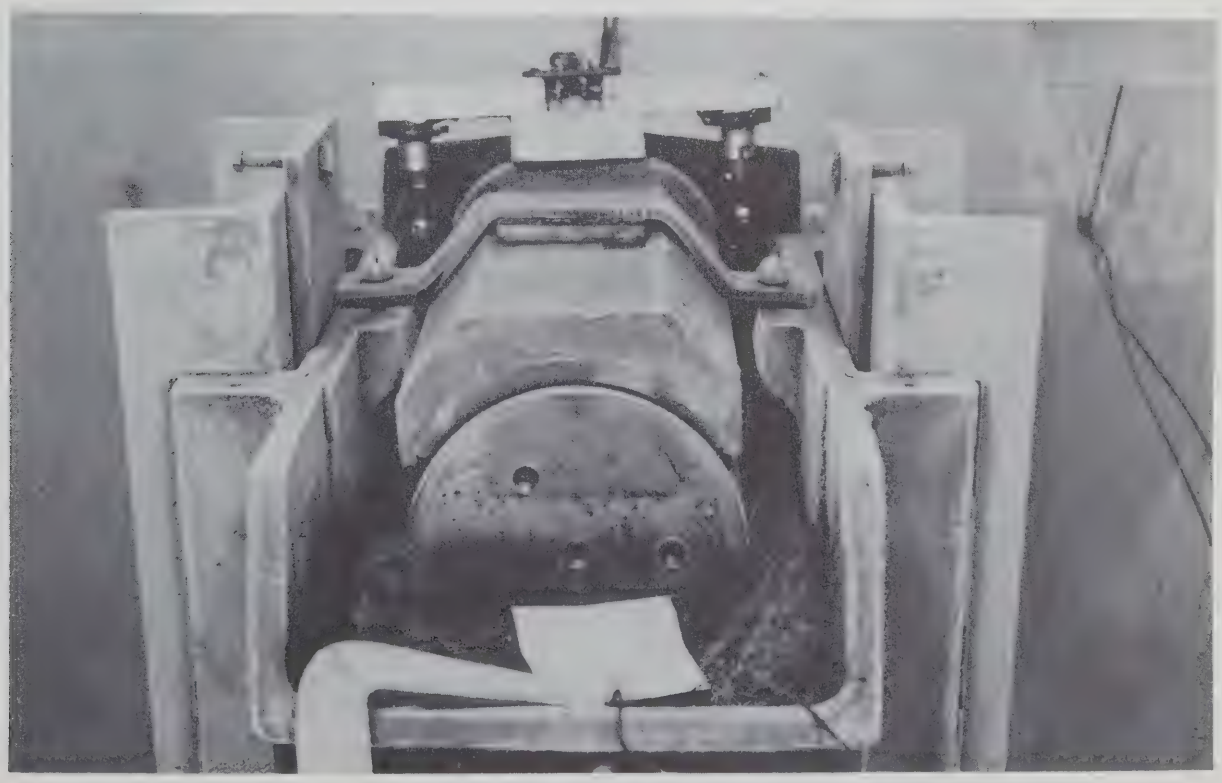
(Below) SHOWING APPLICATION OF THE 1-1/4" RIB IN BOTTOM OF A JOURNAL BOX. THE 3/4" RIB WAS APPLIED IN LIKE MANNER.





(Above) COLD DISPLACEMENT NO. 3a USING NO RIB, SHOWING ONLY SLIGHT ROLLING.

(Below) COLD DISPLACEMENT WITHOUT RIB. SLIGHT.



PART VI

LABORATORY INVESTIGATION OF CORROSION WHEN USING MS-40 AS AN ADDITIVE IN JOURNAL BOX OIL AND REPORT OF VAPORIZATION DURING THE TESTS (MRP-5)

OBJECT OF THE TEST

The object of the test was to investigate under laboratory conditions:

(a) Effect of the addition of the MS-40 extreme pressure sulphur-type additive as a film strengthener when added to car journal oil.

(b) Possible corrosive effect of the MS-40 EP additive on the conventional babbitt linings of car journal bearings.

PROCEDURE

Two available oils were selected and assigned test numbers as follows:

I - EM-904-50, Railway Service & Supply Corporation, Renovated Stock Car Journal Oil.

II - 50-50% Mixture - RS&SC Renovated and Bayou States #57 Neutral - No Additives.

III - Same as II - with 0.75% MS-40 by weight. MS-40 from Burns Laboratory.

IV - Same as II - with 1.50% MS-40 by weight.

Oils and waste packs were prepared in accordance with Standard Procedure developed for the waste-oil schedule, previously illustrated and described in detail in former published reports, using laboratory stock "SS" cotton waste with standard 563 gram packs saturated 3½ oil to 1 waste by weight.

The test was conducted at the Indianapolis Laboratory, using the half-scale, 8-spindle machine, running at 934 RPM. Constant volume cellar shims were used throughout.

The simulated speed with a 33" wheel mounted on the axle was approximately 90 MPH.

The prepared packs were tested by applying the same oil on opposite journals of the same axle, making the assignment as follows:

Oil I - Applied to journals No. 1 and 8.

Oil II - Applied to journals No. 2 and 7.

Oil III - Applied to journals No. 3 and 6.

Oil IV - Applied to journals No. 4 and 5.

The test started December 12, 1951, and mileage accumulated to 25,239 miles at conclusion, January 10, 1952. This mileage would represent only 1/2 of the normal journal surface travel over the bearing because of the reduction in journal size. Intermittent stops were made, governed by laboratory working schedule, and for overnight standing preceding W-O Feed checks. Feed checks were made at start, and at approximately 5,000 mi., 10,000 mi., 15,000 mi., 25,000 mi., and at the finish after the packs were removed, weighed, loosened, and replaced.

Loss of oil from all causes was determined at the end of test, and analysis made where possible (See Table A). The loss is recorded as follows:

Oil I - 120 grams - 13.7%

Oil II - 314 grams - 35.8%

Oil III - 268 grams - 30.6%

Oil IV - 305 grams - 34.8%

A small amount of oil was lost from other causes, but most of the loss is assigned to vaporization.

Prior to the start of the test, all the bearing linings, which were used in many previous tests, showed some discoloration. Unable to satisfactorily remove this discoloration with various solvents, they were "cleaned-up" by running in the machine for 8 hours with straight mineral oil packing. The appearance was good afterwards.

A complete photographic record of the bearings was made prior to starting the test, and upon completion. Reproductions of the pertinent photographs follow in this report. The originals showing the bond between the babbitt and bearing back were magnified 36 times. Photographs of the magnified appearance of the top of the waste packs showed some discoloration, but no glazing, and are not reproduced.

Figures 1 and 2, pages 65 and 66, show graphically the trend of the excess oil feed in relation to the mileage made by the bearings. Table B, page 67, is a summary of selected data compiled from the log sheet readings recorded throughout the test.

DISCUSSION OF RESULTS

(a) The use of MS-40 caused pronounced discoloration of the conventional babbitt lining of the bearings, but apparently had no other effect that might be detrimental to lining or base metal during the assigned mileage used for this test. No discoloration was encountered with any oils other than those containing MS-40.

The appearance of pitting of the bearing surface is entirely discoloration. The spots had no depth.

(b) The use of MS-40, if anything, somewhat enhanced the oil feed during the early stages of the test and seemed to have no detrimental effect to the waste-pack, such as glazing, carbonization, or fouling normal channels of flow.

(c) The "lighter" or blended oils, as tested, tended to vaporize quite early, eventually resulting in increase in viscosity, and apparently other properties were affected.

(d) Lubrication by all oils tested was sufficient at all times, but bearing temperatures were considerably higher during the last W-O Schedule run after packs were disturbed.

(e) Addition of MS-40 increased the film strength at time of application as indicated by the Almen type film strength rating readings listed on the last line of Table A.

Association of American Railroads

Indianapolis Lubrication Laboratory

TABLE A

PHYSICAL PROPERTIES AND FILM STRENGTH RATINGS OF OILS TESTED

(Mechanical Research Project No. 5)

OIL CONSTITUENT / SPECIFICATION ITEMS	OIL NO. I (Run in jrnls 1 & 8) RS&SC STOCK RENOVATED CAR JOURNAL OIL		OIL NO. II (Run in jrnls 2 & 7) 50% STOCK RENOVATED blended with 50% BAYCU NO. 57 NEUT.		OIL NO. III (Run in jrnls 3 & 6) SAME AS NO. II but with 0.75% (by weight) of MS-40 EP ADDITIVE		OIL NO. IV (Run in jrnls 4 & 5) SAME AS NO. II but with 1.50% (by weight) of MS-40 EP ADDITIVE	
	Before Test	After Test	Before Test	After Test	Before Test	After Test	Before Test	After Test
VISCOSITY, Saybolt Seconds								
at 0°F *	40,000	75,000	6200	33,000	6000	24,000	6200	27,000
at 100°F	330	478.6	124	293	123	228	126	251
at 210°F	52.6	59.2	40.7	49.7	40.5	46.4	40.7	47.7
VISCOSITY INDEX	85	81	76	73	72	71	71	73
POUR POINT	-20	-15	-30	(1)	-30	-15	-30	-5
FLASH POINT	385	(1)	320	(1)	315	(1)	310	(1)
AIMEN-TYPE FILM STR. RATING	36,762	(1)	29,514	(1)	101,994	(1)	98,370	(1)

(CRL, Chicago, Jan. 17, 1951)

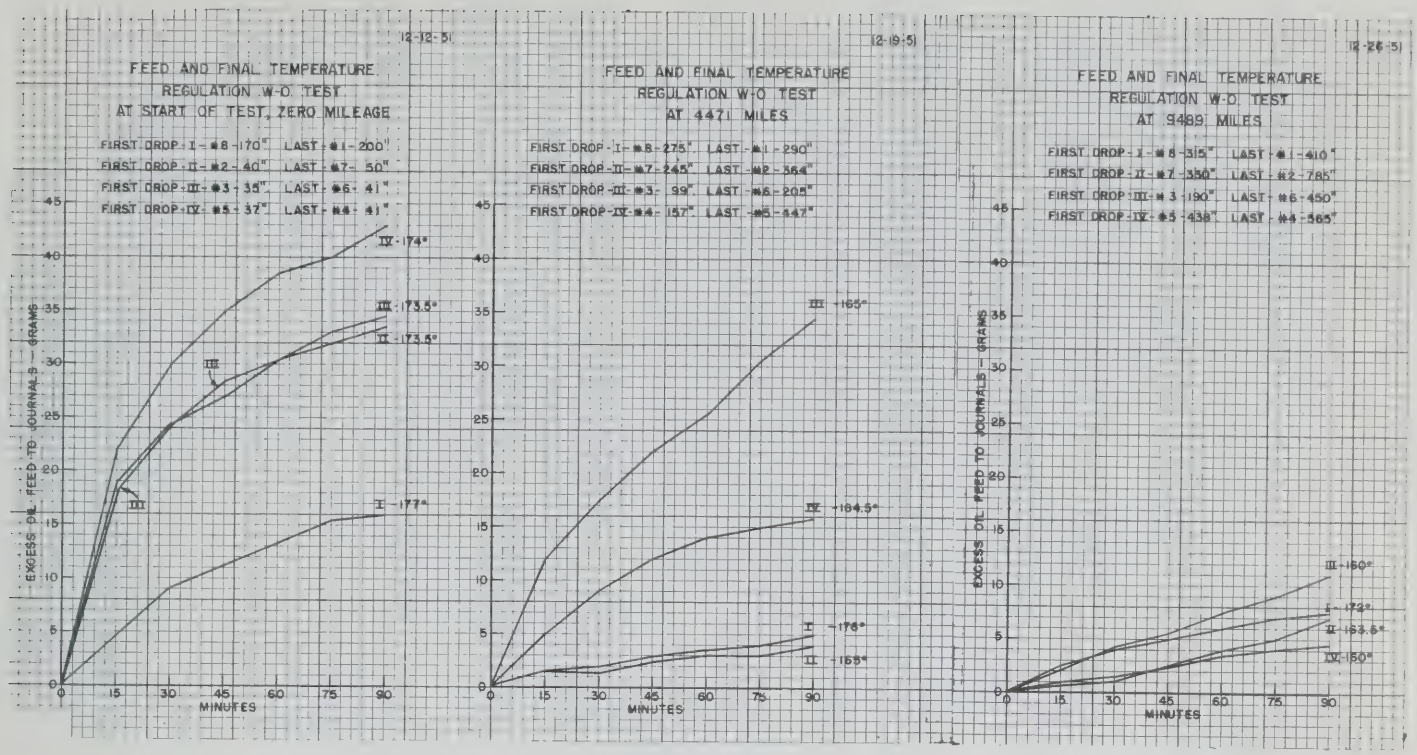
* Extrapolated from abridged ASTM Saybolt Universal Viscosity Chart (D341)

NOTE (1): Amount of oil in waste-packs at end of 25,239-mile run insufficient for laboratory analysis of properties and film strength ratings.

f9100-64

FIGURE - I

f 9100-65


12-12-51
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
AT START OF TEST, ZERO MILEAGE
FIRST DROP - I - #8 - 170" LAST - #1 - 200"
FIRST DROP - II - #2 - 40" LAST - #7 - 50"
FIRST DROP - III - #3 - 35" LAST - #6 - 41"
FIRST DROP - IV - #5 - 37" LAST - #4 - 41"
IV - 174°
III - 173.5°
II - 173.5°
I - 177°
EXCESS OIL FEED TO JOURNALS - GRAMS
MINUTES
12-19-51
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
AT 4471 MILES
FIRST DROP - I - #8 - 275" LAST - #1 - 290"
FIRST DROP - II - #7 - 245" LAST - #2 - 364"
FIRST DROP - III - #3 - 99" LAST - #6 - 205"
FIRST DROP - IV - #4 - 157" LAST - #5 - 447"
III - 165°
IV - 184.5°
I - 178°
II - 165°
MINUTES
12-26-51
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
AT 9489 MILES
FIRST DROP - I - #8 - 315" LAST - #1 - 410"
FIRST DROP - II - #7 - 350" LAST - #2 - 785"
FIRST DROP - III - #3 - 190" LAST - #6 - 450"
FIRST DROP - IV - #5 - 438" LAST - #4 - 565"
III - 150°
I - 172°
II - 183.5°
IV - 150°
EXCESS OIL FEED TO JOURNALS - GRAMS
MINUTES

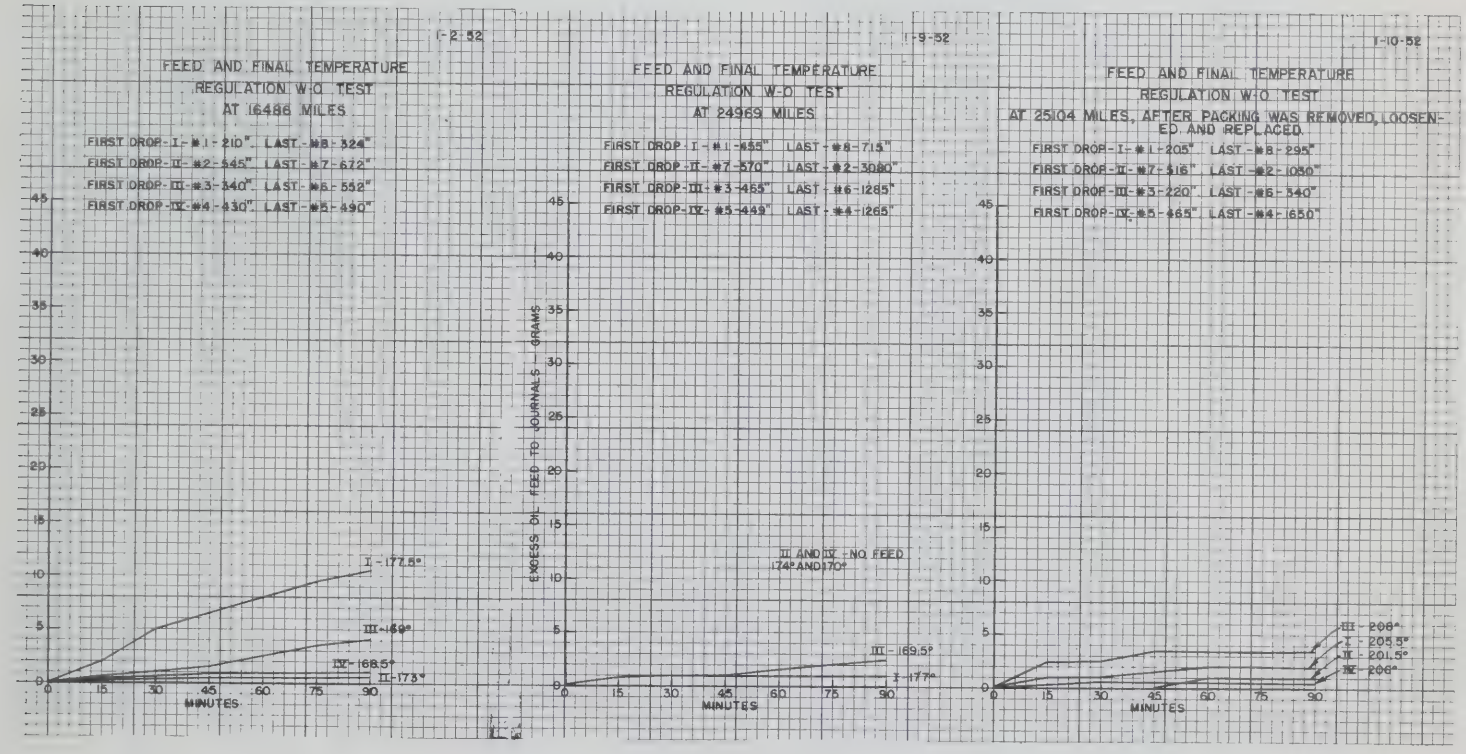
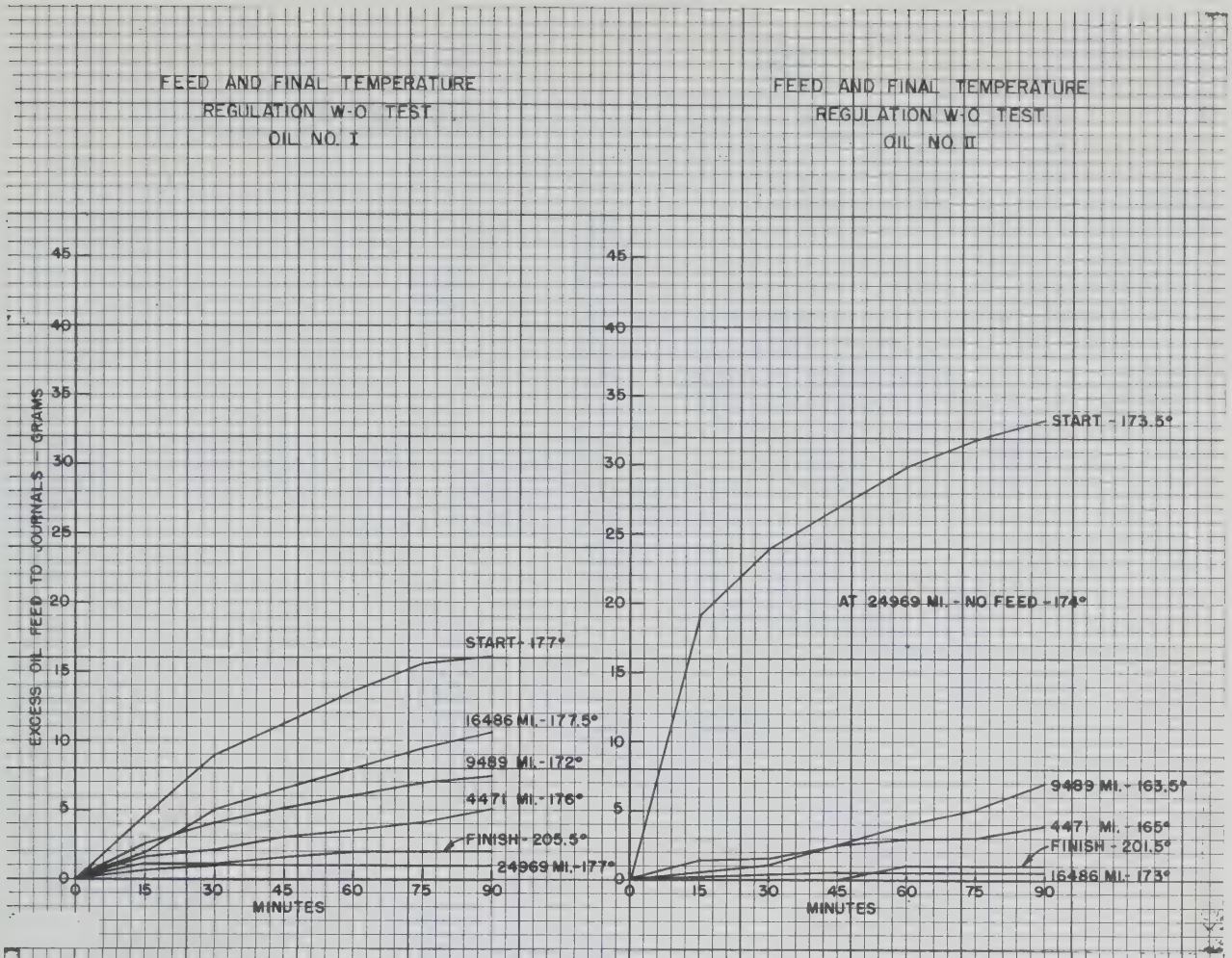
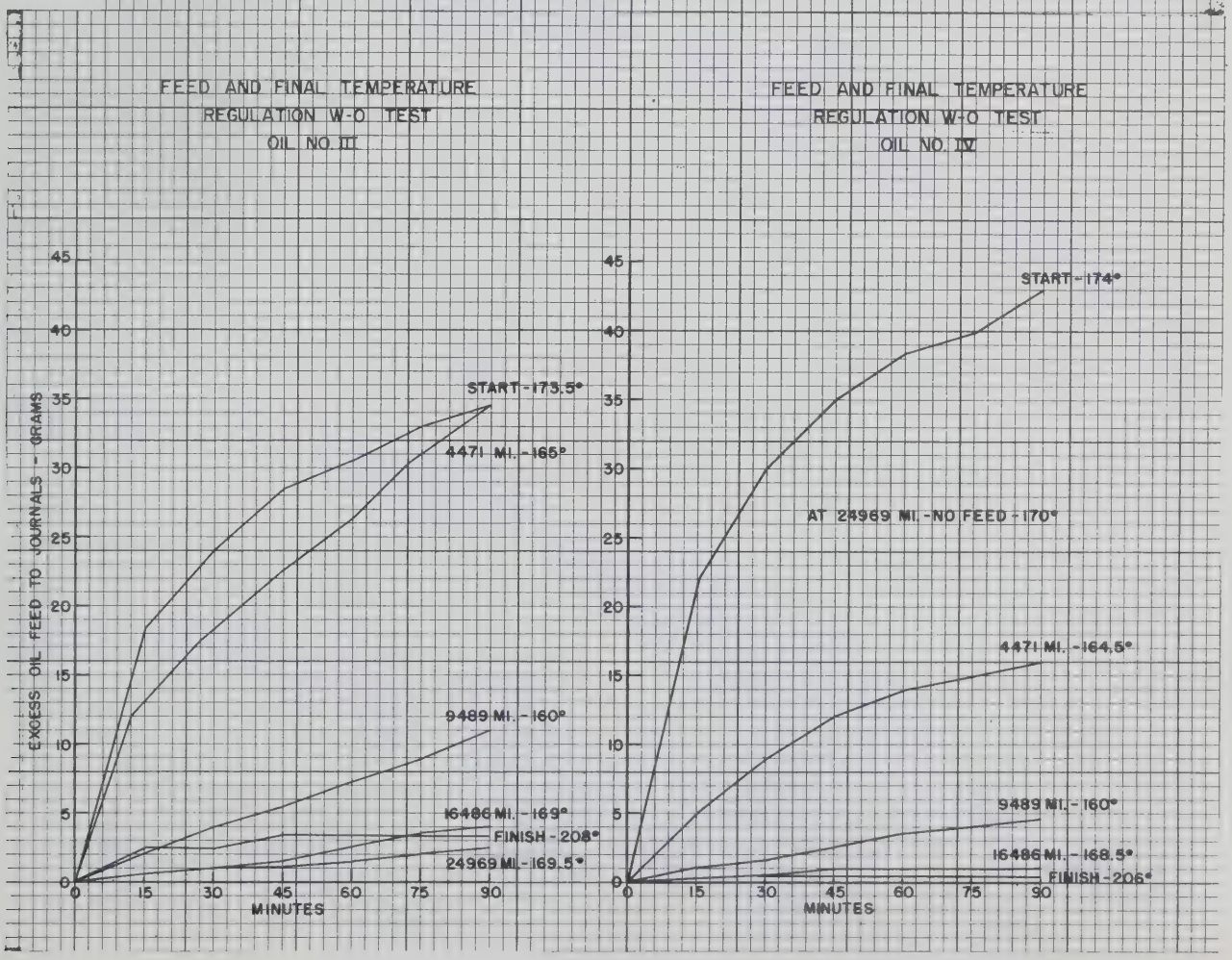

1-2-52
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
AT 16486 MILES
FIRST DROP - I - #1 - 210" LAST - #8 - 324"
FIRST DROP - II - #2 - 545" LAST - #7 - 672"
FIRST DROP - III - #3 - 340" LAST - #6 - 552"
FIRST DROP - IV - #4 - 430" LAST - #5 - 490"
I - 177.5°
III - 169°
IV - 168.5°
II - 173°
EXCESS OIL FEED TO JOURNALS - GRAMS
MINUTES
1-9-52
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
AT 24969 MILES
FIRST DROP - I - #1 - 455" LAST - #8 - 715"
FIRST DROP - II - #7 - 570" LAST - #2 - 3080"
FIRST DROP - III - #3 - 455" LAST - #6 - 1285"
FIRST DROP - IV - #5 - 449" LAST - #4 - 1265"
II AND IV - NO FEED
174° AND 170°
III - 169.5°
I - 177°
MINUTES
1-10-52
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
AT 25104 MILES, AFTER PACKING WAS REMOVED, LOOSENED AND REPLACED.
FIRST DROP - I - #1 - 205" LAST - #8 - 295"
FIRST DROP - II - #7 - 516" LAST - #2 - 1050"
FIRST DROP - III - #3 - 220" LAST - #6 - 340"
FIRST DROP - IV - #5 - 465" LAST - #4 - 1650"
III - 208°
I - 205.5°
II - 201.5°
IV - 206°
MINUTES

FIGURE-II


FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
OIL NO. I
EXCESS OIL FEED TO JOURNALS - GRAMS
MINUTES
START - 177°
16486 MI. - 177.5°
9489 MI. - 172°
4471 MI. - 176°
FINISH - 205.5°
24969 MI. - 177°
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
OIL NO. II
MINUTES
START - 173.5°
AT 24969 MI. - NO FEED - 174°
9489 MI. - 163.5°
4471 MI. - 165°
FINISH - 201.5°
16486 MI. - 173°


FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
OIL NO. III
EXCESS OIL FEED TO JOURNALS - GRAMS
MINUTES
START - 173.5°
4471 MI. - 165°
9489 MI. - 160°
16486 MI. - 169°
FINISH - 208°
24969 MI. - 169.5°
FEED AND FINAL TEMPERATURE
REGULATION W-O TEST
OIL NO. IV
MINUTES
START - 174°
AT 24969 MI. - NO FEED - 170°
4471 MI. - 164.5°
9489 MI. - 160°
16486 MI. - 168.5°
FINISH - 206°

Association of American Railroads

TABLE B

Indianapolis Lubrication Laboratory

TABULATION OF SELECTED DATA OF W-O SCHEDULE TESTS

Special 8-Journal Dynamic Machine - 2 3/4" x 5" Journals - Speed 934 RPM - Simulating 90 MPH for 90 Minutes.

Uniform Direction of Rotation - Constant Volume Shims - 50-Pound Journal Load.

	Start of Test				After 1471 Miles				After 9089 Miles				After 16486 Miles				After 24969 Miles				Final 25104 Miles			
	Oil I	Oil II	Oil III	Oil IV	Oil I	Oil II	Oil III	Oil IV	Oil I	Oil II	Oil III	Oil IV	Oil I	Oil II	Oil III	Oil IV	Oil I	Oil II	Oil III	Oil IV	Oil I	Oil II	Oil III	Oil IV
Temperatures, °F																								
Bearings, at Conc. of 90 Min. Run																								
Maximum	182	176	182	176	178	166	172	165	177	164	168	161	183	174	179	169	184	176	179	171	211	204	224	208
Minimum	172	171	165	172	174	164	158	164	167	163	152	159	172	172	159	168	170	172	160	169	200	199	192	204
Average	177	173.5	173.5	174	176	165	165	164.5	172	163.5	160	160	177.5	173	169	168.5	177	174	169.5	170	205.5	201.5	208	206
Room, at Conclusion	72	72	72	72	69	69	69	69	62	62	62	62	72	72	72	72	68	68	68	68	73	73	73	73
Brg. Rise Above Atmos. Temp.	105	101.5	101.5	102	105	96	96	95.5	110	101.5	98	98	105.5	101	97	96.5	109	106	101.5	102	132.5	128.5	135	133
Excess Oil to Bearings - Grams																								
Maximum	19	37	36	51	6	5	59	27	12	11	20	8	12	1	8	2	1	0	5	0	3	1	5	1
Minimum	13	30	33	35	4	3	10	5	3	3	2	1	9	0	0	0	1	0	0	0	1	1	2	0
Average	16	33 5	34.5	43	5	4	34.5	16	7.5	7	11	4.5	10.5	0.5	4	1	1	0	2.5	0	2	1	3.5	0.5
Ratio, Temp. Rise/Grams, Excess	6.56	3.04	2.95	2.38	21.0	24.0	2.78	59.3	14.7	14.5	8.9	21.8	10.0	202	24.5	96.5	109	-	40.6	-	76.2	128.5	38.6	266

Average Temperature at which Mileage was Accumulated °F.

Oil I	Oil II	Oil III	Oil IV
185.6	176.2	172.6	173.4

All Oil Fed was Poured Back into Cellar.

Final Run after Packing was Removed, Loosened and Replaced.

Total Oil Lost

Oil I	Oil II	Oil III	Oil IV
13.7%	35.8%	30.6%	34.8%

Central Research Laboratory, Chicago, Jan. 31, 1952.

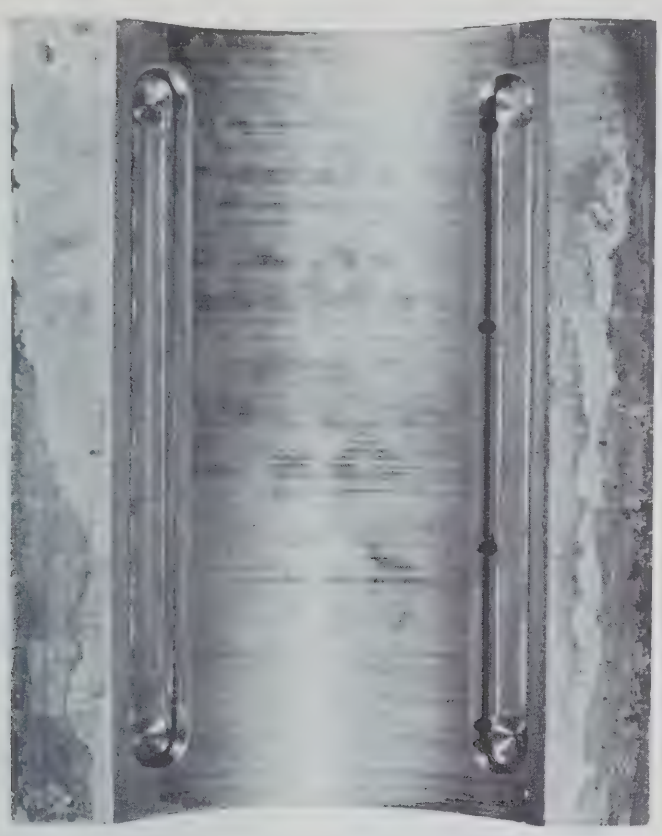
f9100-67

TEST BEARINGS BEFORE AND AFTER TEST
(MRO PROJECT NO. 5)

f9100-68

OIL NO. II : 50% STOCK RENOVATED
50% NO. 57 NEUTRAL

BEFORE TEST



7

2

AFTER TEST

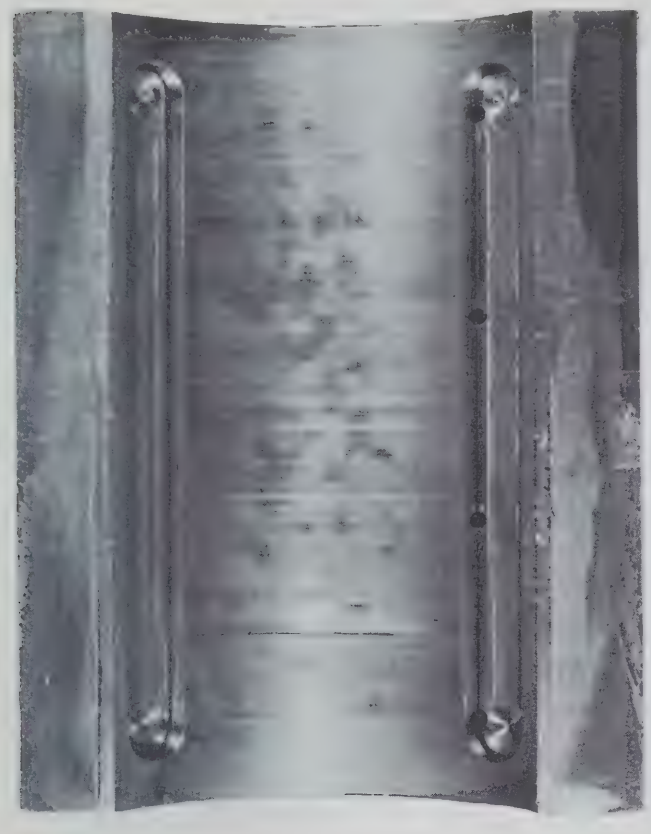
TEST BEARINGS BEFORE AND AFTER TEST

f9100-69

(MRO PROJECT NO. 5)

OIL NO. III: 50% STOCK RENOVATED
50% NO. 57 NEUTRAL
.75% MS-40

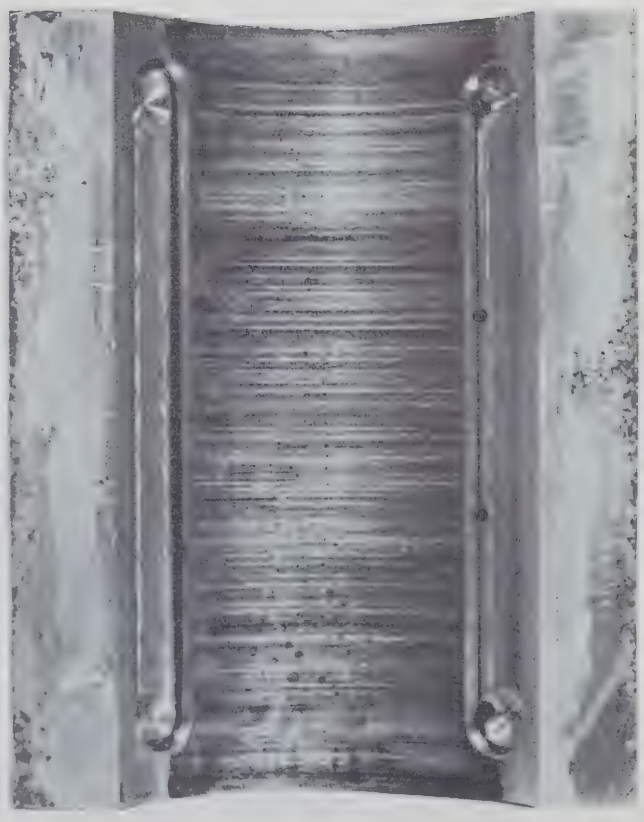
BEFORE TEST



6

3

AFTER TEST



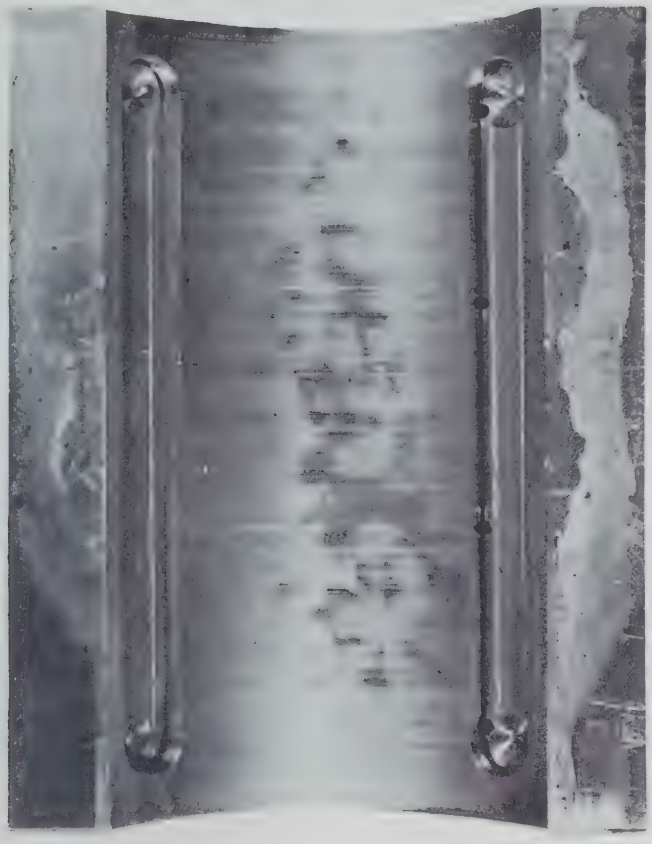
TEST BEARINGS BEFORE AND AFTER TEST

f9100-70

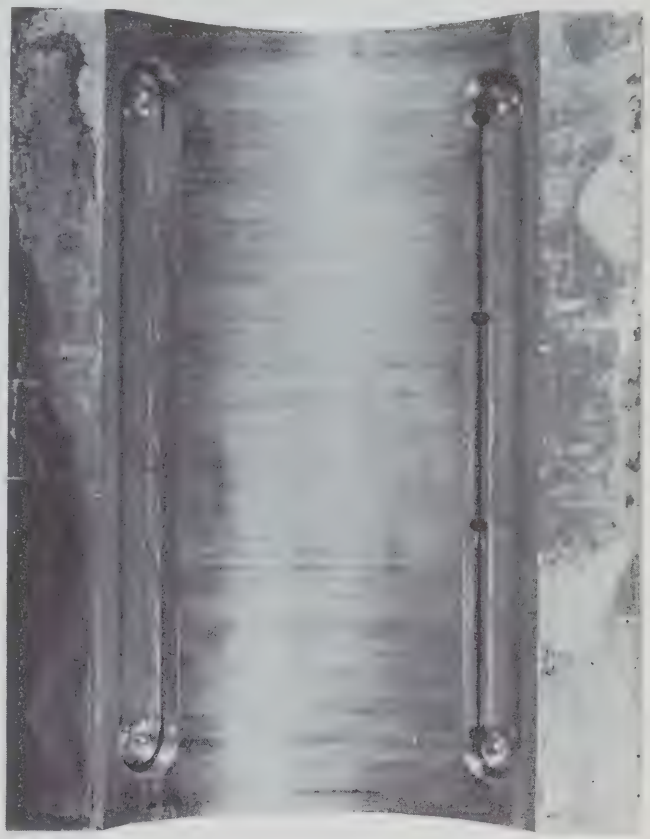
(MRO PROJECT NO. 5)

OIL NO. IV: 50% STOCK RENOVATED
50% NO. 57 NEUTRAL
1.5% MS-40

BEFORE TEST



5



4

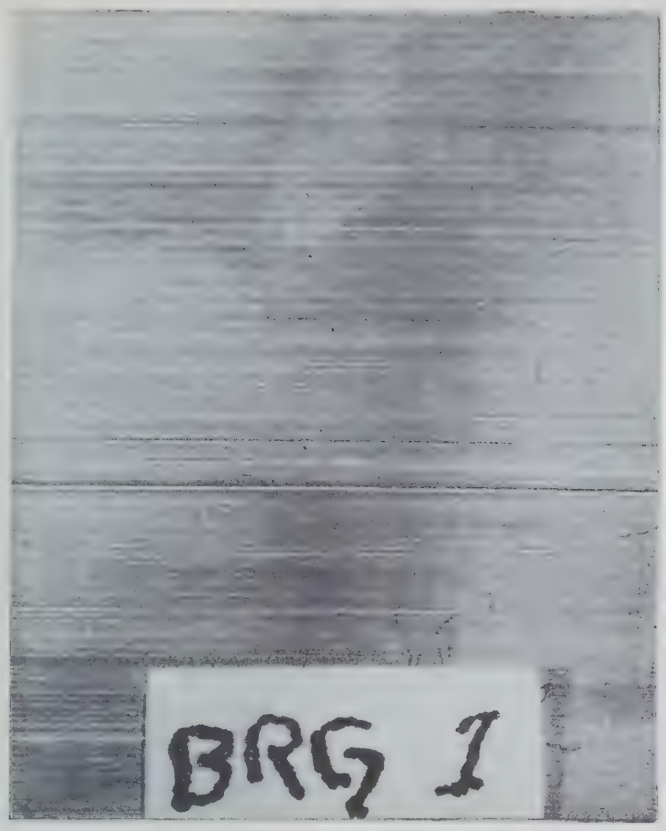
AFTER TEST

MAGNIFICATION OF BEARING SURFACE (X 18)

Detail of Crown Area

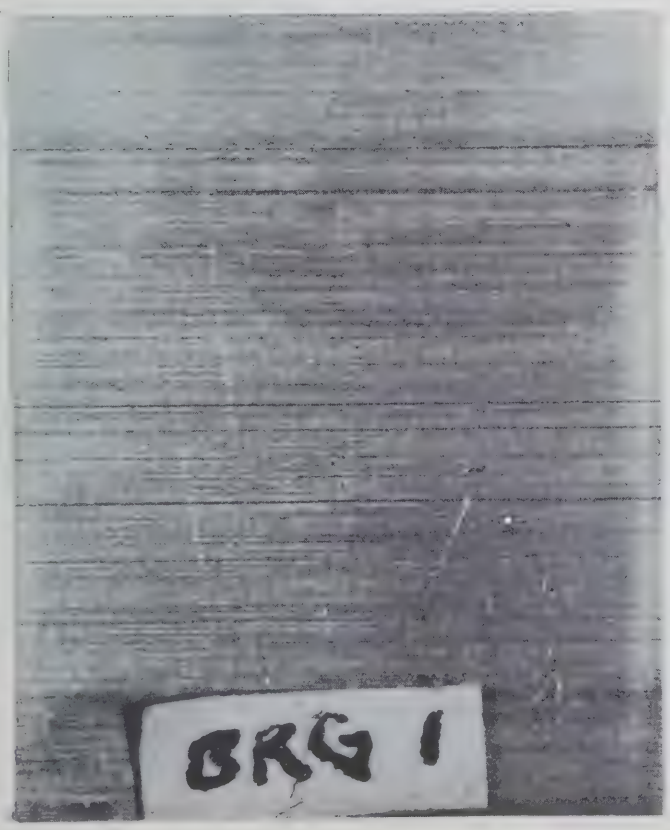
OIL I - RS & SC STOCK RENOVATED

BEFORE TEST



(NO ADDITIVES)

AFTER TEST



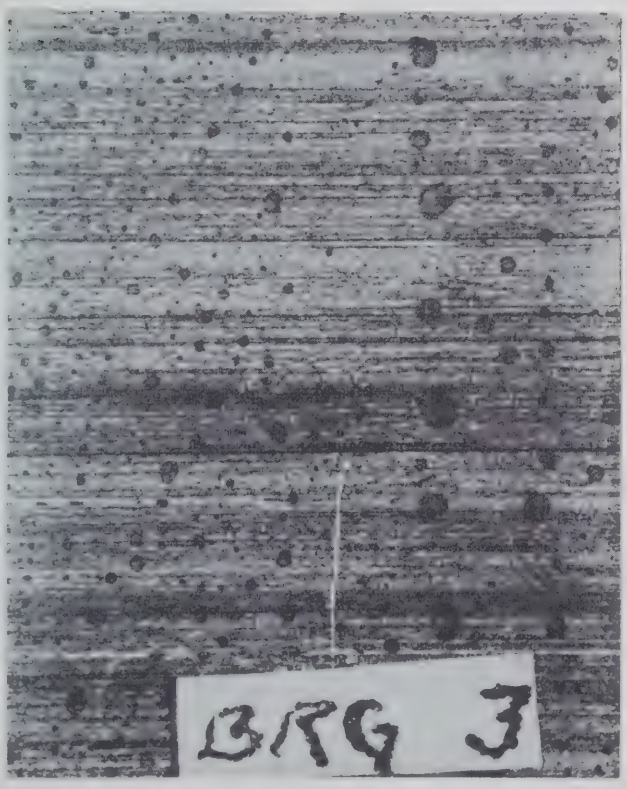
MAGNIFICATION OF BEARING SURFACE (X 18)

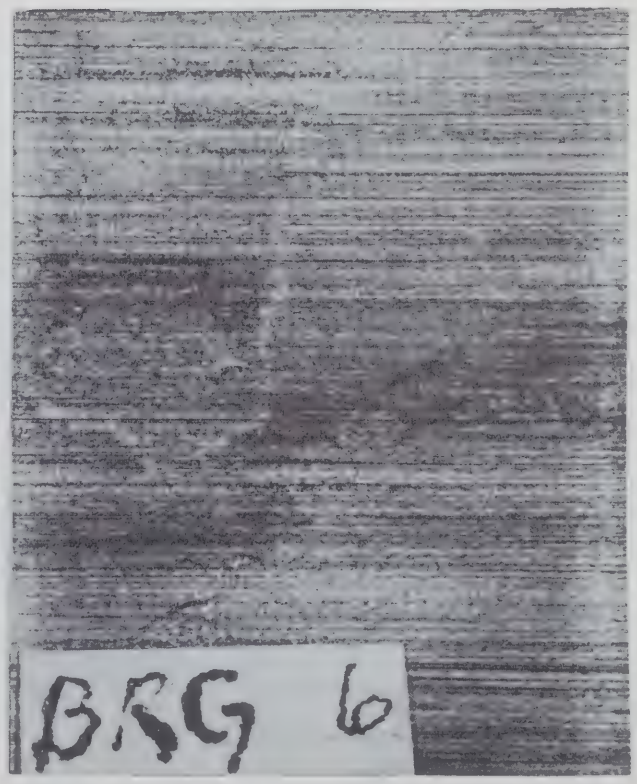
Detail of Crown Area

OIL III - 50% STOCK RENO., 50% NO. 57, NEUTRAL, .75% MS-40

BEFORE TEST

AFTER TEST





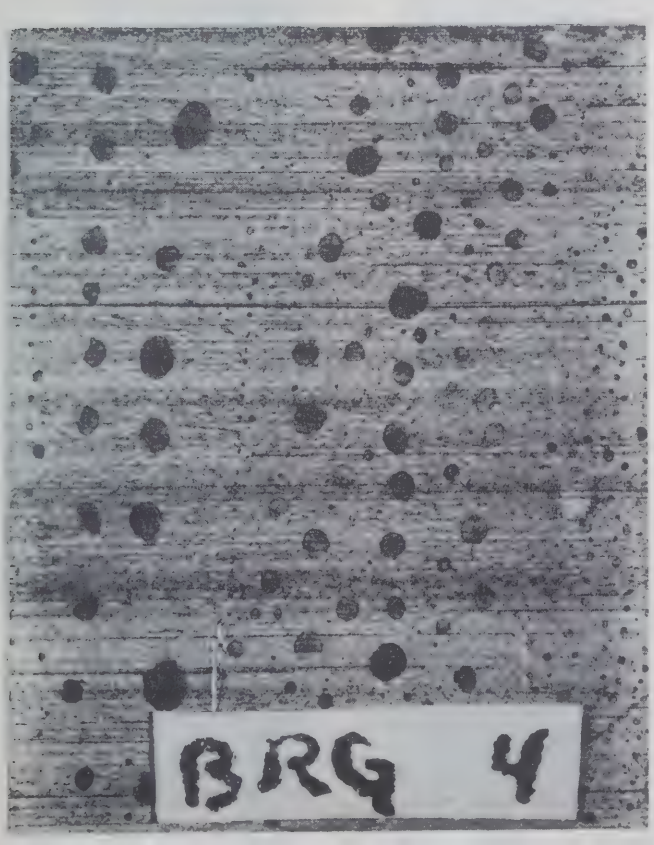
MAGNIFICATION OF BEARING SURFACE (X 18)

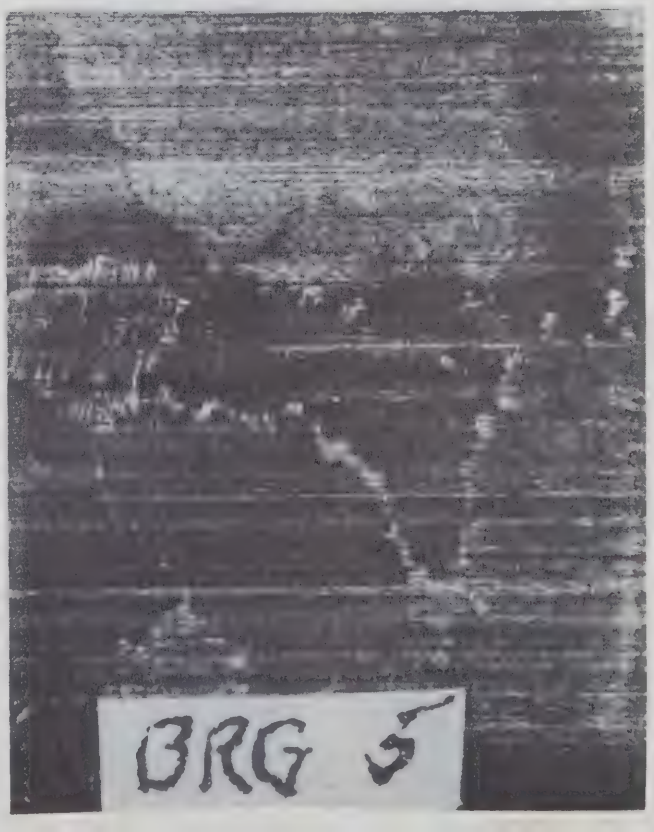
Detail of Crown Area

OIL Ⅳ - 50% STOCK RENO., 50% NO. 57 NEUTRAL, 1.5% MS-40

BEFORE TEST

AFTER TEST





MAGNIFICATION OF BEARING END AREA (X36)

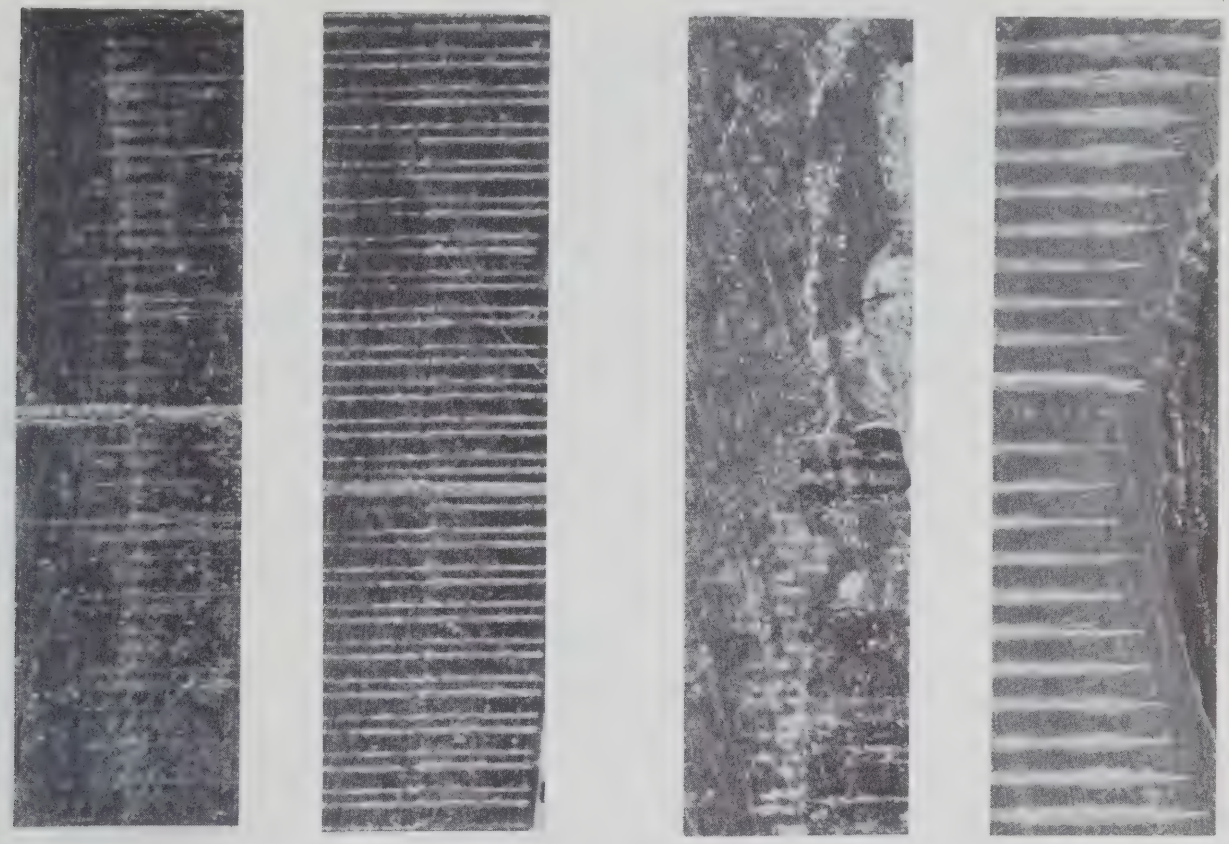
(DETAIL: JUNCTION OF BABBITT AND BASE METAL)

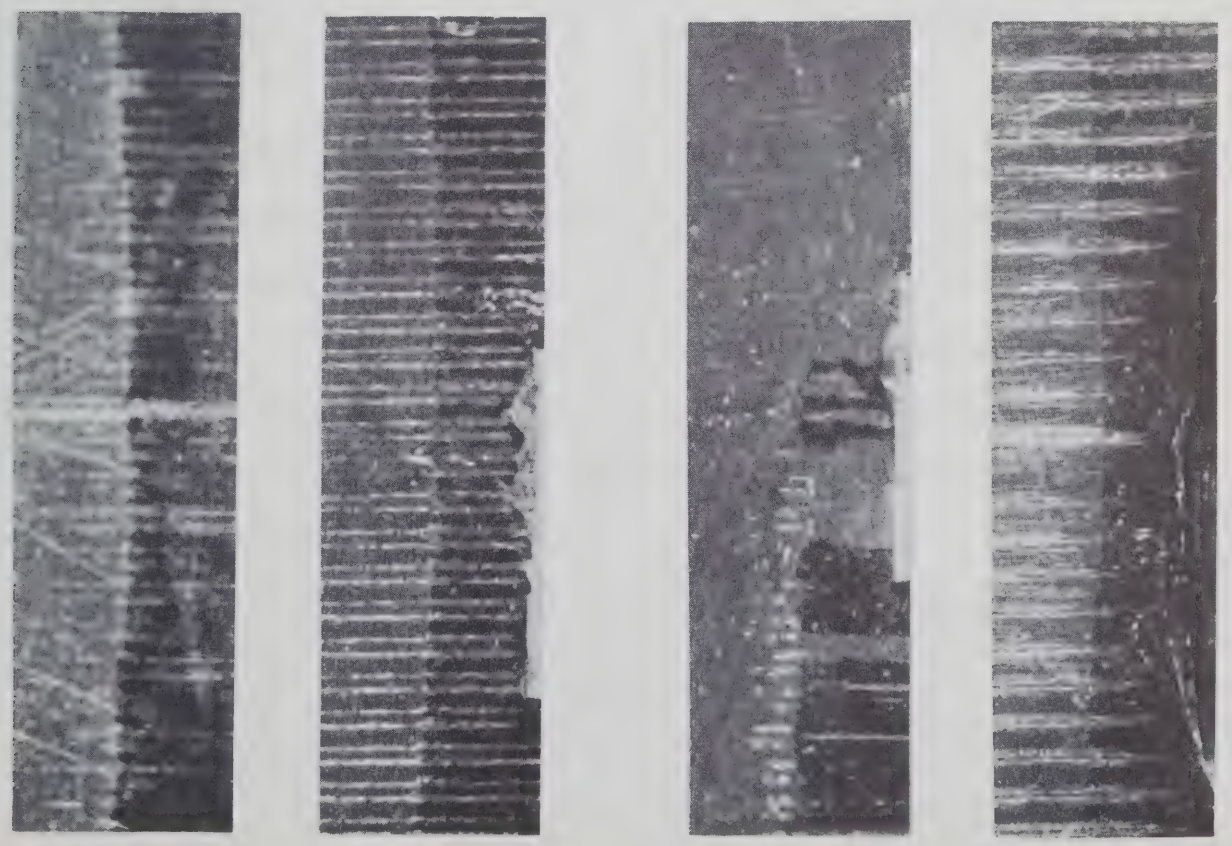
OIL IV - 50% STOCK RENOVATED
50% NO. 57 NEUTRAL
1.5% MS-40

OIL III - 50% STOCK RENOVATED
50% NO. 57 NEUTRAL
.75% MS-40

BEFORE TEST

AFTER TEST





PART VII

LABORATORY INVESTIGATION OF A CELLULOSE "SPONGE" AS A SUBSTITUTE FOR CONVENTIONAL JOURNAL BOX PACKING (MRP-16.1)

- - - - - - - -

OBJECT OF THE TEST

The tests were conducted to evaluate lubricating qualities and characteristics of a cellulose product as a substitute for journal box packing. The product was furnished through the Santa Fe Railway System, and was a synthetic sponge in moulded form sawed to shape. One set consisted of three equal pieces to be applied to the journal box. Another set consisted of one piece sawed to the shape of a rectangular prism, and was mounted in a cradle supported on a small leaf spring to produce journal contact. Other pieces of the material were used to determine absorption and wicking characteristics.

PROCEDURE

Test 1. Three piece set. As received and used, these pieces had been sawed to shape to approximate the contour of the box and journal. When saturated and squeezed into the journal box, the material made contact with the journal and box in a very similar area as that of conventional packing. (See photograph on page 81)

The test was conducted on the full size journal pilot machine located at the Central Research Laboratories. This machine is illustrated in Section 1, Part II of this Progress Report, and photographs are included in this Part on page 80. This machine was originally built for another purpose, but was converted for tests of this nature by enclosing the journal assembly in a controlled temperature box. This test was the initial test of any kind conducted on the machine, and was used to help formulate a test procedure.

The cellulose material was soaked in new hot car journal oil, AAR Specification EM-906-50, in a manner similar to soaking new waste for packing. The dry

weight of the material was 288 grams and when saturated and drained, 1983 grams, or a ratio of 5.88 of oil to 1.00 of sponging. It was then applied to the journal box without much difficulty, since the journal is collarless. Oil was then added to form a small reservoir supply in the bottom of the box. Due to the construction of the machine, only a token load was applied, consisting of the weight of the journal box assembly held firmly in contact with the journal by spring pressure.

The initial run with above conditions was made to develop temperature. At a speed of 50 miles per hour simulated for a 33" wheel, and at an ambient temperature of 74°F., the bearing developed a temperature of 284°F. after a run of 3 hours and 44 minutes. The machine was then stopped, and the packing examined in place, and the entire assembly permitted to "freeze down" overnight.

While frozen down in an ambient temperature of 36°F. below zero, breakaway starts and a short run at 4.5 MPH were made and the packing action observed. At a later date, a cold breakaway test of the same materials was made, but employing an approved waste pack retainer.

OBSERVATIONS

Test 1. Three piece set. At the end of the short run under hot conditions, the packing showed no ill effects from the 284°F. bearing temperature. The lubrication and oil feed seemed excellent, and there was no indication that the sponging would slough off or disintegrate.

During the cold breakaway test, the sponging tended to adhere to, and move with, the journal surface, but there was no general rolling. At the completion, a space was noted on each side of the journal, at top edge of packing, where the sponging was no longer in contact with the journal. A 0.30" feeler could be inserted full length in the opening. Following this, the journal box was raised 1/16",

compressing the packing, then was released. The packing remained away from the journal, showing practically no recovery or resiliency.

Later, pieces of the saturated material were placed in similar temperature and then compressed 3/4" in a vise. The material remained in compressed condition after release and did not tend to return to its original dimension until thawing was complete. After one of the freeze down tests, one of the blocks was considerably distorted when removing it from the journal box. When last observed, two months later, it was still distorted, showing practically no recovery, and was unfit for further use as packing.

When the cold breakaway test was made with an approved waste pack retainer in place, the pressure of the retainer induced rolling of the material downward, tending to roll the sponging under the journal. It was pulled 1/2" away from the side of the box at downward rotation side, and this induced severe packing pressure at the journal. The opposite side appeared undisturbed.

PROCEDURE

Test 2. One piece, spring supported. Following Test 1, another test piece was furnished sawed to fit into a spring cradle, best described by photographs on page 82.

In general, the same procedure was followed as that employed in Test 1 with the three piece set, except longer test runs were made. Considerable difficulty was encountered in application of the device into the box, and after application, the spring was compressed against the bottom of the box and its action somewhat nullified by pressure of the sponge against the side of the spring cradle. The top of the journal box was removed for better observation, and no bearing was employed.

Two hot runs and two cold runs constituted the test, simulating 1,885 miles with a 33" wheel. The first hot run of eight hours simulated 350 miles; 120 miles at 40 MPH and the balance at 50 MPH. The ambient temperatures ranged from 71°F. at

the start, gradually increasing to 126°F. at the finish. The maximum journal temperature was finally 222°F. This temperature was lower than during the first test, due to lower packing pressure against the journal. After an overnight shut down, a second eight-hour run at 50 MPH completed a total of 1,100 miles. The ambient, as before, ranged from 72°F. to 131°F., and the maximum journal temperature was finally 227°F.

An overnight freeze-down followed, and the test was continued 605 miles starting at an ambient temperature of 39°F. below zero which gradually raised to 14°F. below zero at the end of the eight-hour run, ranging from 60 to 96 MPH. The maximum journal temperature was 155°F.

After a 16-hour overnight shut down, maintaining refrigeration, the test was completed the following day, starting with an ambient temperature of 36°F. below zero, and gradually rising during a 5-hour run at 96 MPH to 63°F. The maximum bearing temperature was 197°F.

Each cold test started with a 4.5 MPH breakaway test. Other than a slight movement of the slack in the cradle, there was no noticeable effect due to cold starting.

OBSERVATIONS

Test 2. One piece, spring supported. It appeared there was adequate oil for lubrication at all times, but this observation had to be a matter of judgment, since the top of the box was removed, and no load or bearing applied. However, at 700 miles, a deposit of what appeared to be fine, clear crystals was noted on both sides of the box. These "crystals" were obviously torn from the "sponge" structure. They apparently were not thrown off the journal by centrifugal force but rather floated to the sides of the box through air currents or electro-static action. They remained on the side of the box in sufficient quantities

to give part of the box surface a fuzzy appearance which was quite noticeable. Photograph of the "sponge" after test is shown on page 82, showing some wear and permanent set.

ABSORPTION

Two dry samples of the material were saturated in A.A.R. Specification EM-904-50, renovated car journal oil, heated to 140°F., then drained of excess oil. Details are shown as follows:

Sample	Dry Wt. grams	Saturated Wt. - grams	Oil Absorbed grams	Saturating Time - hrs.	Draining Time-hrs.	Percent of Oil Retained
1	288	1982	1694	18	66	85.5
2	190	1587	1397	18	1/2	88.0

As the table shows, the absorption and retention of dry samples were excellent.

WICKING ABILITY

A dry sample of the material was placed in a pan of the same oil as used in the absorption test. The sample was held in a constant 1" depth of oil, the remainder protruding upward. After 18 hours at an average ambient temperature of 75°F., oil had risen into the sample a distance of 2-1/2" above the oil level.

DISCUSSION OF RESULTS

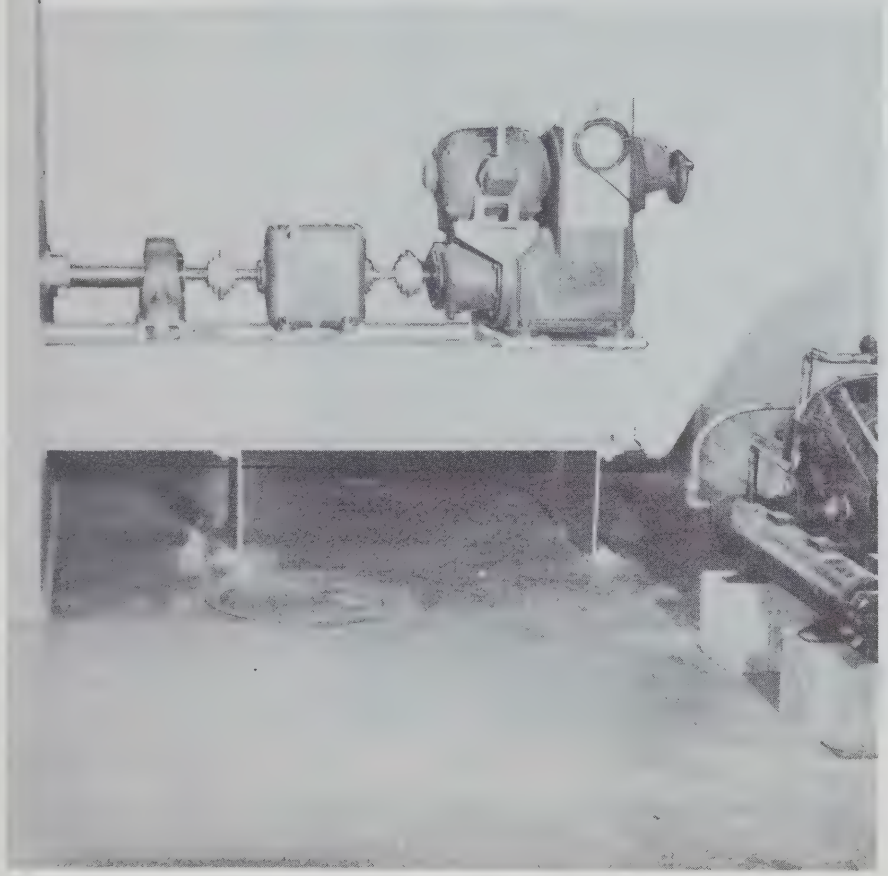
This "synthetic sponge" material, as furnished and tested, is obviously not suitable as a substitute for conventional journal box packing.

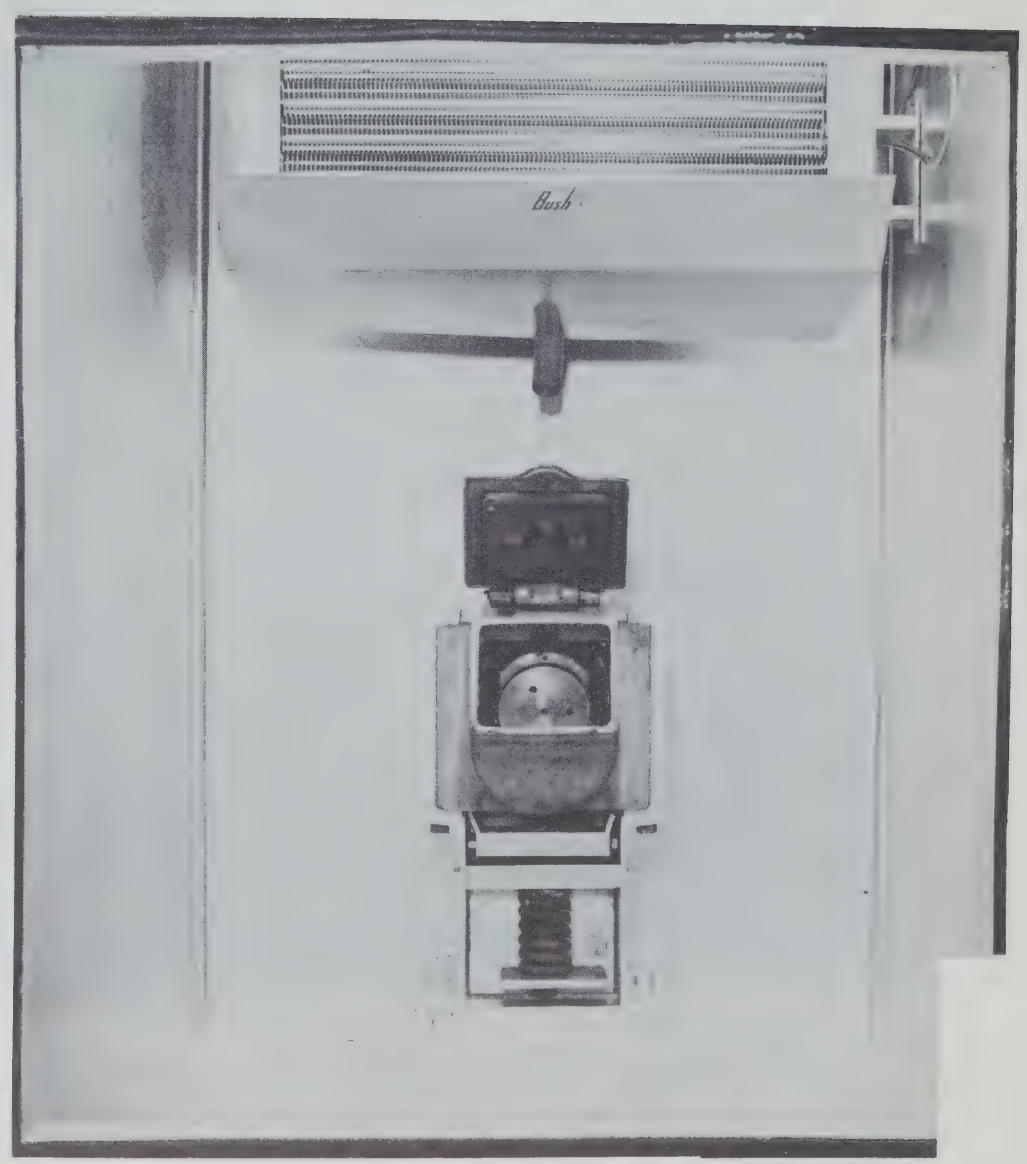
Although the absorption and wicking ability were more than adequate, the test was insufficient to definitely determine wear or glazing characteristics.

The principal failure within the journal box will result from lack of resiliency or recovery of the material during and after being exposed to cold weather. This feature is essential to lubrication of present journal box assemblies.

(Right) LOOKING INTO INTERIOR OF CONTROLLED TEMPERATURE ROOM. TEMPERATURES CAN RANGE TO 40°F BELOW ZERO.

(Below) PILOT MACHINE DRIVE, SHOWING PART OF REFRIGERATOR CONDENSATION UNIT. SIMULATED SPEEDS RANGE FROM 4 1/2 MPH TO 100 MPH (33-INCH WHEEL).





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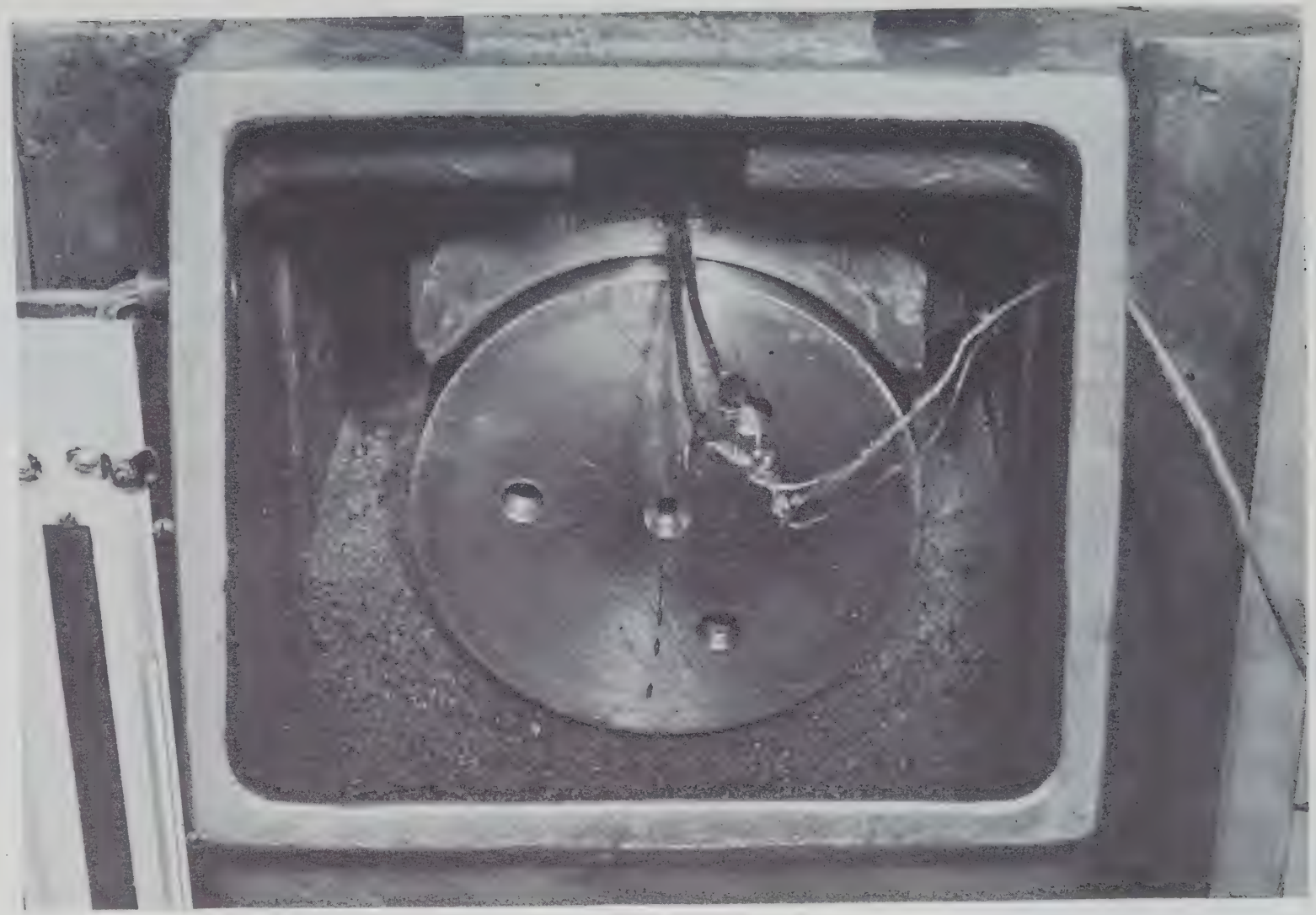
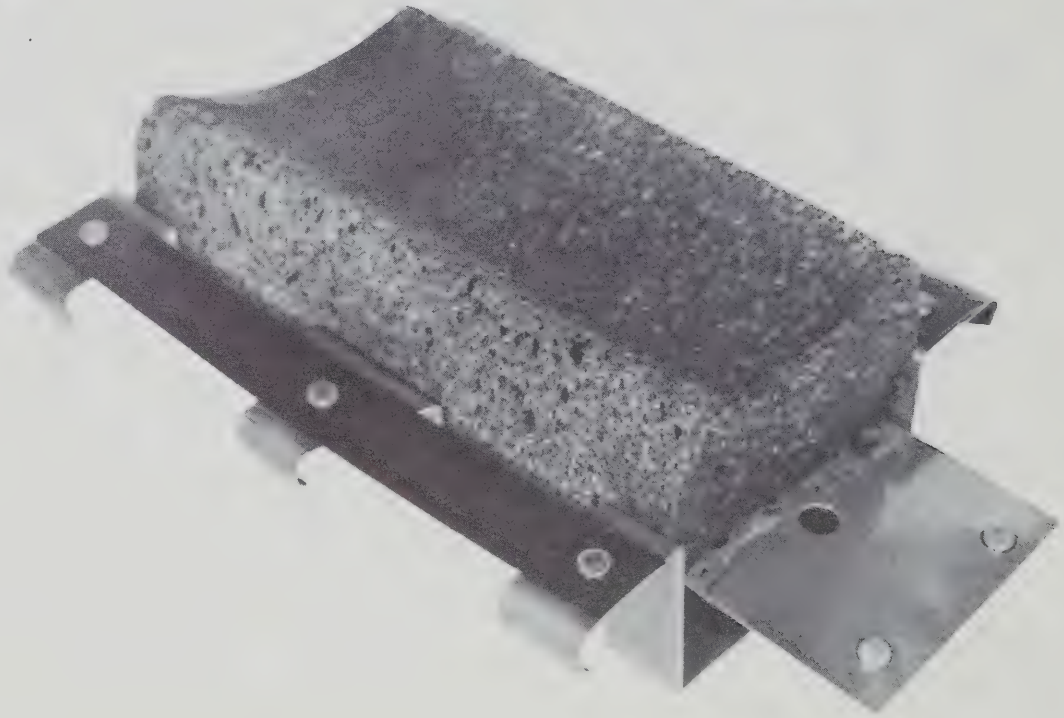


THREE-PIECE SYNTHETIC SPONGE AS APPLIED FOR TEST IN 5 1/2" X 10" JOURNAL BOX ASSEMBLY IN PILOT MACHINE AT CENTRAL RESEARCH LABORATORIES.



(Above) View of spring-supported cradle and synthetic sponge material before application to journal box.

(Above, right) View of lubrication device assembled for application, before saturation.

(Right) View of synthetic sponge lubrication device when removed after tests)

f9100-82

PART VIII

LABORATORY TEST OF A GLASS FIBER AS A SUBSTITUTE FOR CONVENTIONAL JOURNAL BOX PACKING (MRP-16.3)

OBJECT OF THE TEST

In line with the policy to investigate any method or material which might improve the lubrication of car bearings and consequently reduce the frequency of hot boxes. A supplier of glass fiber products cooperated by furnishing test samples.

PROCEDURE

The glass fiber material tested was furnished in loosely pressed blanket form, 1" thick, and cut in strips 10" wide. The fiber diameter is of the nature of .00025". The fibers were in single strands, not warped. The material was treated with silicone resin, making it brown in color.

Wicking Ability: The ability of the glass fiber to raise oil above a fixed level was determined by immersing the end of two loosely rolled samples in a pan of oil in which the oil level was held constant at 1" by a constant level device. The rolls were approximately 3-1/2" in diameter, and stood on end in the oil, and were supported by a grid which permitted oil to contact the roll on the sides and the lower end. The apparatus and roll are illustrated by Figure I-a and photograph Figure I-b, on page 85. The conditions and results follow:

1. Unheated Oil Bath

   Oil - New. A.A.R. Specification EM-906-50
   Ambient Temperature - Constant, 75°F.
   Time of Immersion - 24 hours.
   Result - Oil rose 1/2" above oil level.

2. Heated Oil Bath

   Oil - New. Same as above.
   Ambient Temperature - Constant, 75°F.
   Oil Temperature - 160°F. for 7 hours, then allowed to cool to ambient for remainder of test.
   Time of Immersion - 24 hours
   Result - Oil rose 1/2" above oil level.

Test in Half-Size 8-Journal Machine. Exploratory tests were set up employing the half-size 8-journal test machine, using the regular W-O test procedure.

This machine and procedure have been frequently described in former Progress Reports, so are not repeated herein. The test was conducted at the Central Research Laboratories in May, 1952.

Previous explorations indicated that loose waste packs made with the glass fiber material might be ejected from the cellars of the machine by the rotating action of the journal. Therefore, the packs were rolled to form, and two oils of different viscosities were used. The method of rolling and the application to the journals of the machine are illustrated in Figures II-a and II-b, page 86.

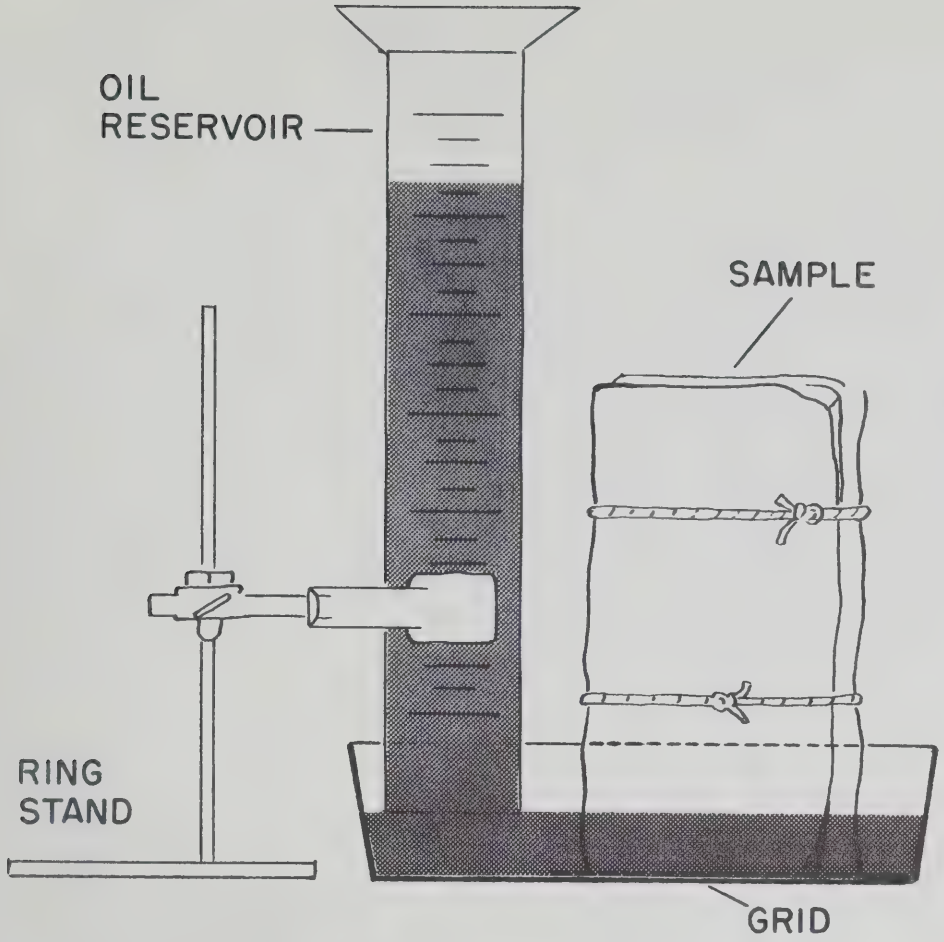
The material was prepared in the following manner: Eight strips 5-1/2" wide and 4 ft. 8 in. long, each weighing 50 grams, were cut to fill each cellar. They were rolled and saturated in accordance with established W-O procedure (438 grams of oil at 200°F. for 5 hours). The packs were applied to the journals in accordance with Figure II-a, using shims on one side and constant pressure weights on the other, and were allowed to stand applied overnight before starting the machine, approximately 17 hours later.

Upon starting the machine for test, the packing rolled out of all the cellars, and the machine was stopped after making 20 revolutions. The ambient temperature was 74°F. Practically complete ejection of the packing was prevented by stopping the machine, and the test was concluded at this point. Photographs showing the condition on both weight and shim side of the machine are on page 87. Photographs of a typical bearing and cellar (No. 3) are shown on page 88, Figures 2-c and 2-d.

DISCUSSION OF RESULTS

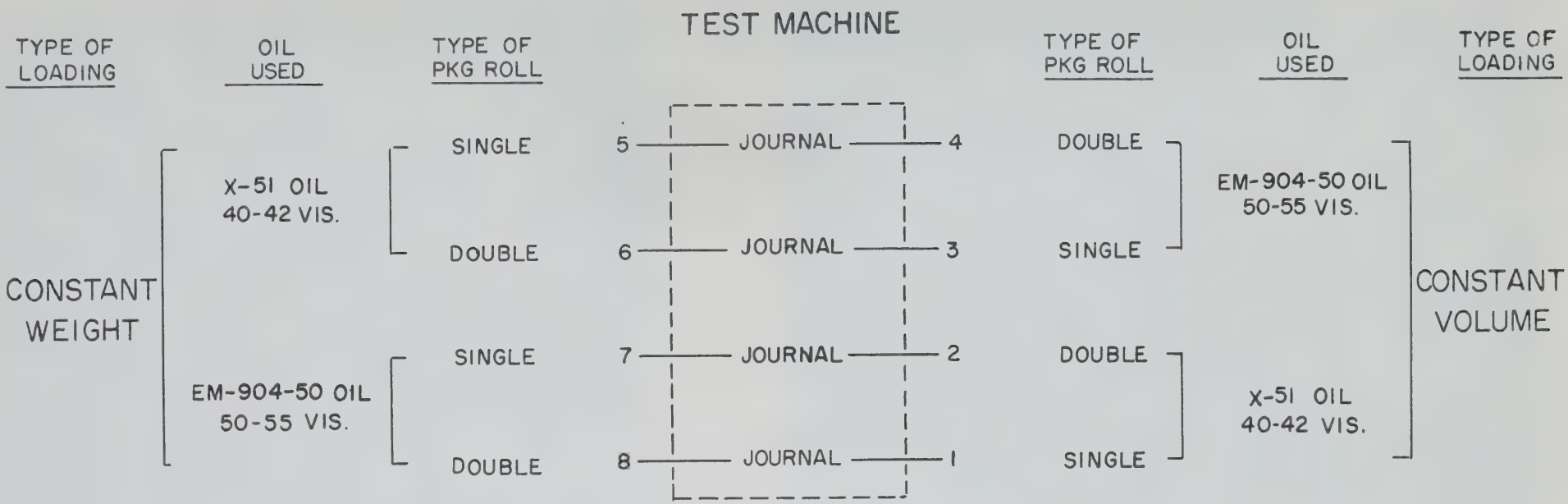
In the tests of the material submitted, the low-strength, low-weight fibers adhere to the journal, crumble and pulverize, and are almost immediately thrown out of position in the box by rotation of the journal.

Fibers, as submitted, have insufficient tensile strength or wicking ability for use as journal box packing.



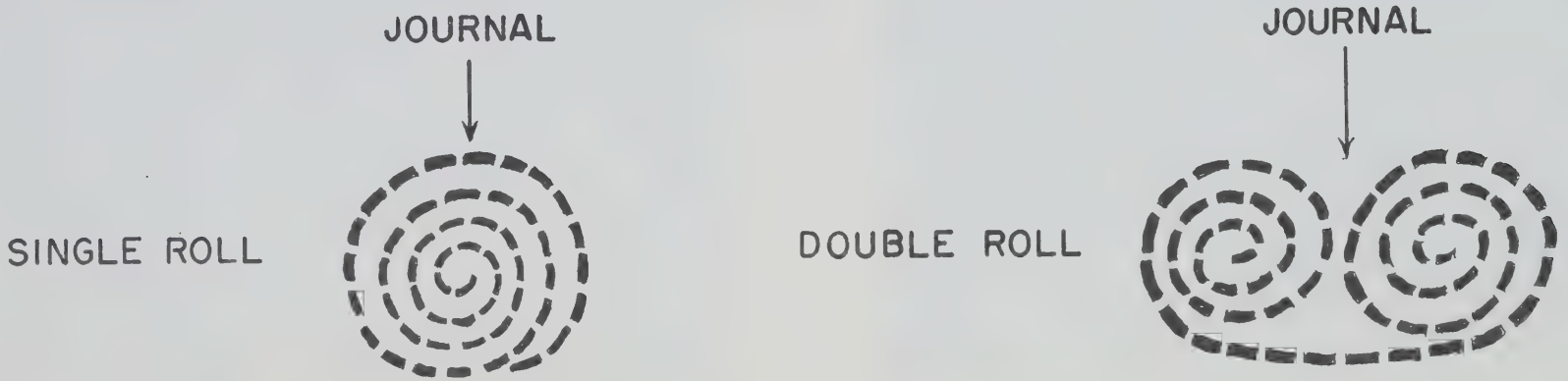
(Left) FIG. I-a
DIAGRAM OF APPARATUS FOR TESTING WICKING ABILITY.

(Below) FIG. I-b
SHOWING 1/2" OIL RISE INTO SAMPLE AFTER 24 HOURS.



(Above) FIG. II-a DISPOSITION OF THREE TEST CONDITIONS AMONG EIGHT JOURNALS OF TEST MACHINE.

(Below) FIG. II-b TWO METHODS OF PACKING PREPARATION.



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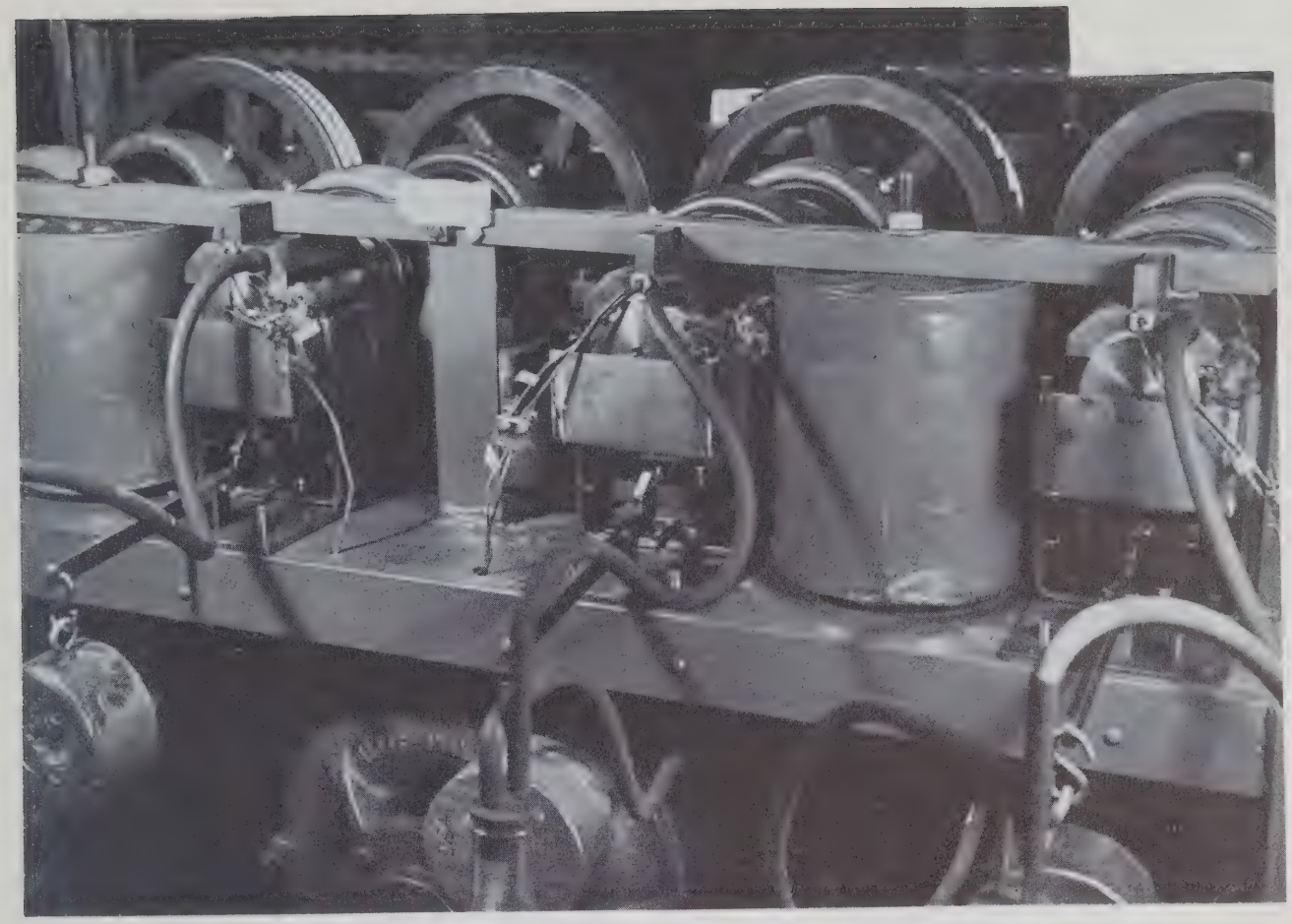
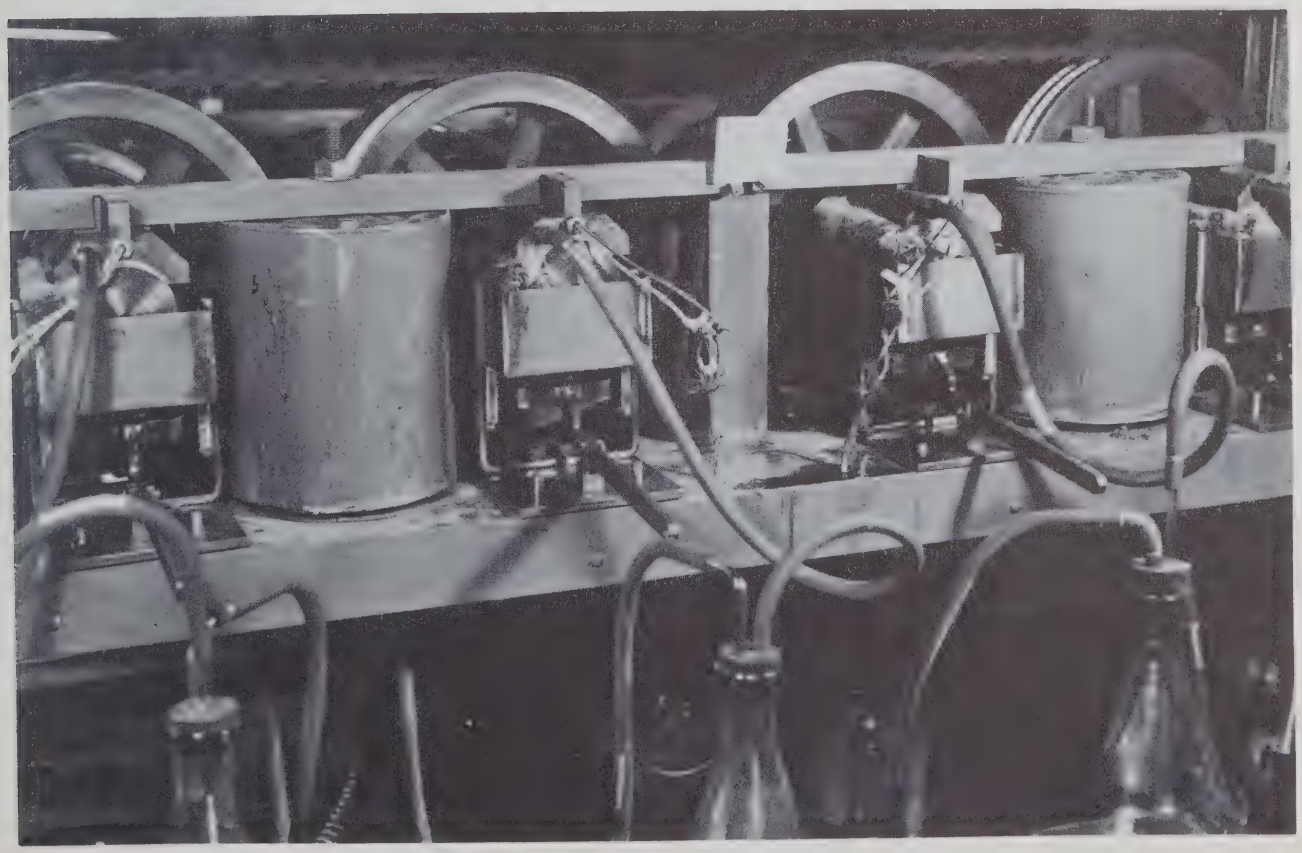
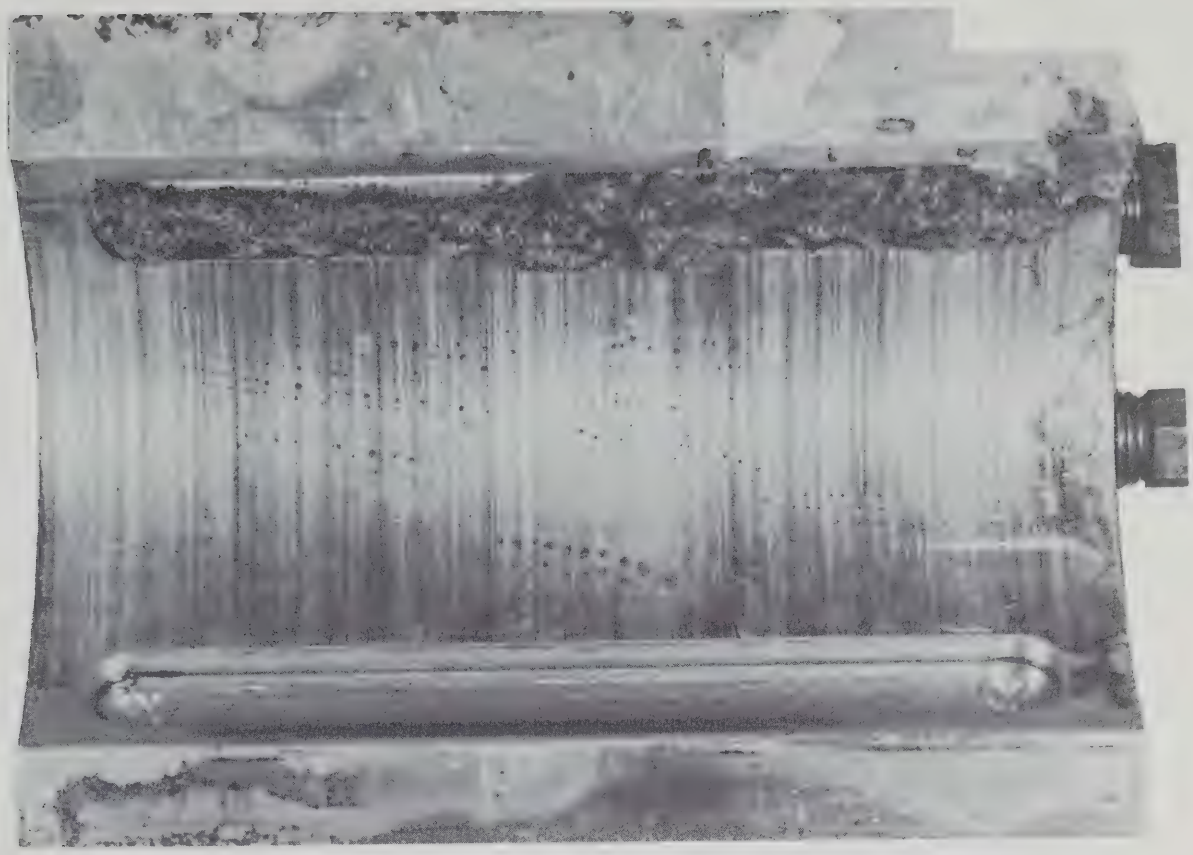


(Above) VIEW OF CONSTANT WEIGHT CELLARS AFTER ONLY 20 REVOLUTIONS OF THE MACHINE.

(Below) VIEW OF CONSTANT VOLUME (SHIMMED) CELLARS AFTER ONLY 20 REVOLUTIONS OF THE MACHINE.





(Above) FIG. 2-c SURFACE OF TYPICAL BEARING AFTER TEST. NOTE CLOGGED LINT SLOT.

(Below) FIG. 2-d CLOSE-UP OF TYPICAL DISPLACEMENT AFTER 20 REVS.

PART IX

LABORATORY STUDY OF DIAMETER AND STRENGTH OF WASTE THREAD (MRP-7.8)

OBJECT OF TEST

The object of the test was to determine if it is feasible to include in the A.A.R. Specification EM-905-50 (New Waste for Journal Box Packing) certain specifications for minimum tensile strength and minimum diameter for the thread to be used in the manufacturing of journal box waste.

PROCEDURE

The various types of threads used in the manufacturing of journal box waste were secured from different sources of supply in various parts of the country. This was done in order to get a better over-all sampling of materials available. Tests were made of both warp and slasher types of thread in various grades, including single and multiple ply threads. Two lots of threads were furnished by the Pennsylvania Railroads; one lot from the Miller Waste Mills, Winona, Minn.; and two lots by the Machined Waste Institute.

The diameter of the thread was determined by placing the thread between the anvil surfaces of a Case Exact Automatic Micrometer which is capable of measuring accurately to .0005".

The tensile strength of the thread was determined by placing the thread in a Thwing-Albert Electro Hydraulic Tensile Tester installed in the A.A.R. Packaging Laboratory. This machine was equipped with special adapters for use when testing the tensile strength of thread, and the rate of feed of the load to the thread was twelve inches per minute. The tensile strength of the threads was determined in accordance with A.S.T.M. Specification No. 76-45.

DISCUSSION OF RESULTS

The results of our study indicate that there is very little uniformity of either tensile strength or diameter of various threads tested. The Soft Slasher with an average tensile or breaking load of approximately 1.5 pounds varied from .003 to .008 of an inch in diameter. The Heavy Slasher thread tensile strength varied from 1.3 pounds to over 6.0 pounds or as much as 500 percent.

The multiple ply warp threads were the strongest threads tested. Certain tapestry cords required twenty-seven pounds of load to break the thread. The strength of the warp thread is governed by the number of plys of thread used in the manufacture of the cord.

The laboratory tests indicate that it is not practicable to write an enforceable specification for diameter and strength of the waste threads now available for journal box packing.

JAN 26 1954

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